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Evaluation of Primary Air Vitiation for Nitric Oxide Reduction in a Rotary Cement Kiln
Volume 2. Data Supplement A

KVB, Inc., Irvine, CA

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EVALUATION OF PRIMARY AIR VITIATION FOR NITRIC OXIDE REDUCTION IN A ROTARY CEMENT KILN

Volume 2. Data Supplement A

by

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16. ABSTRACT
The report gives results of tests to evaluate combustion modifications for nitric oxide (NO) reduction and cement product quality in a pilot-scale long-dry-process cement kiln firing pulverized coal. The kiln is rated at 11.35 kg/s (1080 tons/day) of cement with a thermal input rate of 70.3 MW (240 million Btu/hr). Of the combustion modifications evaluated in previous studies, vitiation of the primary air with inert gas (nitrogen) was considered the best alternative for NO reduction on a pilot-scale kiln. As-found emissions (17 days of data, 89.75 hours) were about 3.6 kg (8 lb) NO as NO_2 per 907 kg (1 ton) of clinker. The uncertainty of the as-found mean mass emissions is about 10%. Lowered excess air (LEA) decreased NO volumetric and mass emissions by about 15-20%. The percent reduction was established from a reference baseline of 1050 ppm (corrected to 3% O_2) and a kiln exit oxygen of 1.82%. The NO volumetric emissions were lowered to 880 ppm (corrected to 3% O_2) with a kiln exit oxygen of 0.7%. NO_x reductions during the short term nitrogen injection tests were about 25-30% with no adverse effects on product quality. Because of the interacting feed chemistry/kiln operations, it was not possible to clearly isolate the effect of nitrogen injection. For long term operation, flue gas recirculation would be more cost effective in achieving primary air vitiation.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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Cements	Stationary Sources	11B, 13C
Kilns	Cement Kilns	13A
Nitric Oxide (NO)	Primary Air Vitiation	07B
Combustion	Combustion Modification	21B
Pulverized Fuels		21D

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This document has been reviewed in accordance with U.S. Environmental Protection Agency policy and approved for publication. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

ABSTRACT

KVB has been funded by the U.S. Environmental Protection Agency to conduct research for emission reduction from industrial processes. One phase of this research effort concerns NO reduction from cement kilns. Tests were conducted on a 1100 ton/day long, dry process cement kiln to evaluate the effect of primary air vitiation on NO emissions. Primary air vitiation was accomplished by injecting nitrogen gas into the primary air. As found, test results (17 days, 89.75 hours) prior to the nitrogen injection test were used to assess the inherent variability of the cement-making process. The NO emissions averaged about 8 lb NO_2/ton of clinker and varied approximately 30 percent during the as-found test series. Lowering kiln exit oxygen from 1.8 percent to 0.7 percent reduced NO by 15-20 percent. Three days of nitrogen injection tests for primary air vitiation were also performed at the test site. Although the testing demonstrated that nitrogen injection will reduce NO, the extent of reduction is extremely variable and is based on the operations and kiln feed at the time. NO mass emissions did decrease 20 to 30 percent, based on altering the burning zone temperature profile (2550°F to 2490°F) and lowering the primary air O_2 from 21 to 13 percent while maintaining a constant kiln exit oxygen of 1.5 percent. No deterioration of clinker quality was observed. For long-term operation, flue gas recirculation would be a more cost-effective means of achieving primary air vitiation.

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LIMITATIONS ON APPLICATION OF DATA REPORTED

The pollutant emission data cited in this report pertain to one specific classification of rotary cement kilns, i.e., long dry cement kilns with no preheat or precalciners. These data should not be used to estimate mean emissions from other types of cement kilns or to predict emission reduction potentials of combustion modifications until modifications have actually been carried out on the different cement kiln. The purpose of this test program was to investigate the feasibility of combustion modifications for emissions control, not to develop a comprehensive emissions data base.

FOREWORD

The purpose of this Data Supplement is to document data in greater detail than was practical in the final report for this contract. It is intended to provide the necessary details to other researchers who are interested in performing their own analysis.

Readers are referred to the contract final reports for information as to objectives, selection of units, measurement procedures, interpretations, and conclusions.*

All data presented for gaseous emission concentrations of NO and CO are expressed in parts per million by volume (ppm) on a dry basis corrected to 3 percent O_2 by volume (dry) in the flue gas.

The data are arranged in this volume by Location Number for Site 2. At this location four distinct data sets were collected. The first data set (September 26 - October 25, 1983) was for as found operations. The second set of data (November 15 and November 17, 1983) was with nitrogen injection of the primary air stream gas. The third data set (February 29 - March 3, 1984) was a combination of as found operations with lowered excess air. The fourth data set (April 17-18, 1984) was the final nitrogen injection test.

For the unit tested, the data supplement contains the following information:

1. Equipment Design Data

   Design data tabulations include: unit description, installation date, process capacity, burner description, fuels burned and other data pertinent to each unit.

2. Mobile Laboratory Data (Emission Measurements)

   Emission measurements tabulated for each test include test number, test load, combustion conditions (O_2, CO_2), gaseous emissions (NO, CO, and all at 3 percent O_2, dry).

3. Operating Data (Control Room)

   Data pertinent to the process are tabulated for each test.

4. Fuel Analyses

Analyses of test fuels are included as reported for fuel samples collected during tests.

5. Instrument Calibration Records

During emissions testing, periodic instrument calibrations are checked for zero and span drift.

6. Nitrogen Injection Data Sheets

During the nitrogen injection testing, the burner line/primary air oxygen content was monitored on a frequent basis.

7. Baghouse Inlet Conditions

A velocity traverse of the baghouse inlet was conducted.

INSTRUMENTATION

All gaseous emission measurements were made in a 12.8 m x 2.4 m (8 x 42 ft) mobile laboratory trailer. The emission measurement instrumentation used was the following:

EMISSION MEASUREMENT INSTRUMENTATION

Species	Manufacturer	Measurement Method	Model No.
Carbon Monozide	Beckman Instruments	IR Spectrometer	865
Oxygen	Teledyne	Polarographic	326A
	Carbon Dioxde	Beckman Instruments	IR
	Spectrometer	864	
Nitrogen Oxides	Thermo Electron Co.	Chemiluminescent	10A

CONVERSION FACTORS
SI units to Metric or English units

To Obtain	From	Multiply By	To obtain ppm at 3% O_2 of	Multiply* Concentration in ng/J by
g/Mcal	ng/J	0.004186	Natural Gas Fuel	
10^6 Btu	GJ	0.948	CO	3.23
Btu	gm cal	3.9685×10^{-3}	HC	5.65
lb/10^6 Btu	ng/J	0.00233	NO or NO_x	1.96
ft	m	3.281	SO_2 or SO_x	1.41
in.	cm	0.3937		
ft^2	m^2	10.764		
ft^3	m^3	35.314	Oil Fuel	
lb	kg	2.205	CO	2.93
Fahrenheit	Celsius	$t_F = 9/5(t_c) + 32$	HC	5.13
Fahrenheit	Kelvin	$t_F = 1.8t_K - 460$	NO or NO_x	1.78
psig	Pa	$P_{psig} = (P_{pa})(1.450 \times 10^{-4}) - 14.7$	SO_2 or SO_x	1.28
psia	Pa	$P_{psia} = (P_{pa})(1.450 \times 10^{-4})$		
iwg (39.2°F)	Pa	$P_{iwg} = (P_{pa})(4.014 \times 10^{-3})$	Coal Fuel	
10^6 Btu/hr	MW	3.413	CO	2.69
GJ/hr	MW	3.60	HC	4.69
			NO or NO_x	1.64
			SO_2 or SO_x	1.18

*These conversions depend on fuel composition. The values given are for typical fuels.

CEMENT KILN DESCRIPTION

Location No. 4

Unit 1

Unit Description: Long, Dry Rotary Kiln
490 ft (149 m) long
13.5 ft (4.1 m) inside diameter
Slope: 7/16 inch per foot

Installation Date: 1962

Rated Capacity: 45 tons/hour (11.34 Kg/s)

Rated Heat Input: 240 x 10^6 Btu/hr (70.3 MW)

Burner Type: Gas/Pulverized Coal Burners; Straight Pipe

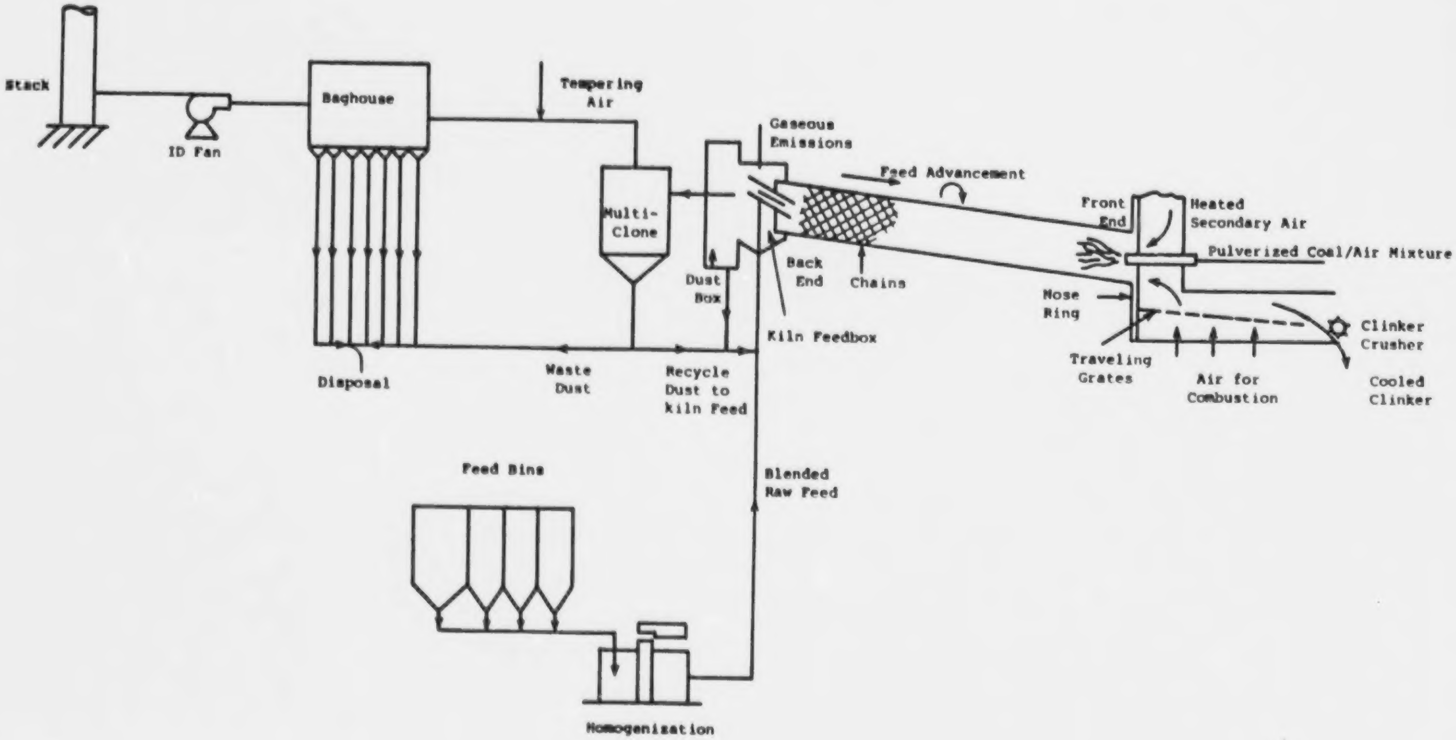
Stack
ID Fan
Baghouse
Disposal
Tempering Air
Multi-Clone
Waste Dust
Recycle Dust to kiln Feed
Dust Box
Gaseous Emissions
Feed Advancement
Back End
Chains
Kiln Feedbox
Front End
Heated Secondary Air
Pulverized Coal/Air Mixture
Nose Ring
Clinker Crusher
Traveling Grates
Air for Combustion
Cooled Clinker
Blended Raw Feed
Feed Bins
Homogenization

Figure 1. Schematic of Dry Process Cement Kiln System

DATA SET 1

SEPTEMBER 26 - OCTOBER 25, 1983

CONTROL ROOM DATA SHEET

KILN #1

DATE 9/26/83

Engineer BCB, KH, RAF

1. Test Number	9/26-1	9/26-2	9/26-3	9/26-4
2. Time	0930	1115	1418	1615
3. Baghouse Inlet Temp., °F	—	—	—	—
4. Baghouse ΔP, "H_2O	—	—	—	—
5. Multiclone Inlet Temp., °F	—	—	—	680
6. Kiln ID Fan Damper Position (% open)	60	60	60	60
7. Oxygen, %	2.0	2.0	0-1.5	2.5-3.5
8. Combustibles/CO_2, %	0/30.4	0/32.0	0/32.0	0/29.6
9. Kiln Chain Temp., °F	1300	1300	1300	1300
10. Kiln End Housing Pressure, in H_2O	-.6	-.6	-.6	-.6
11. Kiln Speed, revs/hr (rph)	58	60-64	68	67
12. Kiln Feeder Speed, revs/min (rpm)	12.	16-17	14.5	14.5
13. CO, ppm	0	0	0	0
14. NO_x, ppm	750	2000	2100	1650
15. Kiln Shell Temp, °F (highest reading)	380	460	200	350
16. Kiln Feed Bin Level (feet down from bin top)	5-8	6-9	4-8	4-8

9/26/83

	1	2	3	4
17. Kiln Load, amps	160	200	300	200-260
18. Kiln Hood Pressure, in H_2O	-.12	-.12	-.12	-.12
19. Cooler Air Temp., °F	1720	1640	1760	1700
20. Cooler Speed, revs/min (rpm)	14	13	13	13
*21. Cooler Undergrate Temperature, °F	O.O.S	O.O.S	O.O.S	O.O.S
22. Cooler Undergrate Pressure, in H_2O	4.6	3.8	4.2	4.6
23. Material Temperature, °F	2240	2520	2600	2500
24. Coal Mill Motor Amps	30	30	30	30
25. Coal Mill Inlet Pressure, in H_2O	-3.4	-3.4	-3.6	—
26. Coal Mill Outlet Pressure, in H_2O	+18.25	+18.25	18.5	18.5
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11.0	11.0	11.0	11.0
28. Cyclone Tempering Air, °F	700	700	700	700
29. Coal Mill Inlet Temperature, °F	460	460	420	450
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	553630 @ 1004 Hrs — —	554950 @ 1126 Hrs — —	557940 @ 1430 Hrs — —	559718 @ 1620 Hrs
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	467260 @ 1000 Hrs — —	468570 @ 1122 Hrs — —	470173 @ 1425 Hrs — —	471156 @ 1617 Hrs — —
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	— — —	— — —	— — —	— — —
33. Feed Type	II	II	II	II
34. Observations				

* O.O.S - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 9/27/83

Engineer RCB, KH, RAF, JM

1. Test Number	9/27-1	9/27-1	9/27-1	
2. Time	0900	1050	1500	
3. Baghouse Inlet Temp., °F	—	—	—	
4. Baghouse ΔP, "H_2O	—	—	—	
5. Multiclone Inlet Temp., °F	620	620	630	
6. Kiln ID Fan Damper Position (% open)	60	60	60	
7. Oxygen, %	2.3	1.5	—	
8. Combustibles/CO_2, %	0/32.0	0/31.2	0/32.8	
9. Kiln Chain Temp., °F	1300	1280	1300	
10. Kiln End Housing Pressure, in H_2O	-.6	-.6	-.55	
11. Kiln Speed, revs/hr (rph)	74	74	64	
12. Kiln Feeder Speed, revs/min (rpm)	16.0	16.25	14.0	
13. CO, ppm	0	0	0	
14. NO_x, ppm	1500	1125	950	
15. Kiln Shell Temp, °F (highest reading)	200	400	300	
16. Kiln Feed Bin Level (feet down from bin top)	4-9	4-10	4-10	

17. Kiln Load, amps	260	220-260	200	
18. Kiln Hood Pressure, in H_2O	-.13	-.10 - -.14	-.12	
19. Cooler Air Temp., °F	1650	1680	1600	
20. Cooler Speed, revs/min (rpm)	13	13	13	
21. Cooler Undergrate Temperature, °F	O.O.S	O.O.S	O.O.S	
22. Cooler Undergrate Pressure, in H_2O	4.6	4.7	4.4	
23. Material Temperature, °F	2520	2460	2340	
24. Coal Mill Motor Amps	30	30	30	
25. Coal Mill Inlet Pressure, in H_2O	-3.5	-3.7	-3.3	
26. Coal Mill Outlet Pressure, in H_2O	+18.3	+17.8	+19.0	
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11.0	11.0	11.0	
28. Cyclone Tempering Air, °F	700	700	700	
29. Coal Mill Inlet Temperature, °F	430	470-480	440	
30. Coal Feed Rate Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .01 x 12 = tons/hr**	576180 @ 0912 Hrs — —	577910 @ 1058 Hrs — —	581982 @ 1509 Hrs — —	
31. Clinker Belt Scale Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .1 x 12 = tons/hr**	O.O.S all clinker on Kiln #2, belt #1	O.O.S	480112 @ 1508 Hrs — —	
32. Kiln Feeder Revs Integrator **t = 0 minutes** **t = 5 minutes** **(Δ/5 = rpm)**	— — —	— — —	— — —	
33. Feed Type	II	II	II	
34. Observations				

O.O.S- Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 9/28/83

Engineer LL

1. Test Number	9/28-1	9/28-2	9/28-3	9/28-4
2. Time	0900	1020	1200	1302
3. Baghouse Inlet Temp., °F	–	–	–	–
4. Baghouse ΔP, "H_2O	–	–	–	–
5. Multiclone Inlet Temp., °F	640	625	650	640
6. Kiln ID Fan Damper Position (% open)	59	58	59	60
7. Oxygen, %	1.3	1.4	1.5	1.0
8. Combustibles/CO_2, %	0	0	0	0
9. Kiln Chain Temp., °F	1310	1310	1310	1300
10. Kiln End Housing Pressure, in H_2O	-.61	-.65	-.68	-.68
11. Kiln Speed, revs/hr (rph)	75	70	75	76
12. Kiln Feeder Speed, revs/min (rpm)	15.8	14.7	15.5	16.0
13. CO, ppm	0	0	0	0
14. NO_x, ppm	1025	850	1250	1300
15. Kiln Shell Temp, °F (highest reading)	–	–	–	–
16. Kiln Feed Bin Level (feet down from bin top)	7	–	–	–

4/28/83

	1	2	3	4
17. **Kiln Load, amps**	270	225	255	270
18. **Kiln Hood Pressure, in H_2O**	-.14	-.10	-.12	-.12
19. **Cooler Air Temp., °F**	1650	1650	1630	1620
20. **Cooler Speed, revs/min (rpm)**	13	13	11	11
21. **Cooler Undergrate Temperature, °F**	O.O.S	O.O.S	O.O.S	O.O.S
22. **Cooler Undergrate Pressure, in H_2O**	4.7	5.0	4.2	4.3
23. **Material Temperature, °F**	2440	2275	2510	2550
24. **Coal Mill Motor Amps**	30	30	30	30
25. **Coal Mill Inlet Pressure, in H_2O**	-3.3	-3.5	-3.7	-3.4
26. **Coal Mill Outlet Pressure, in H_2O**	+18.0	+18.0	+18.0	+18.0
27. **Coal Mill Feed Rate, (% scale x 15 tons/hr)**	11.0	11.0	11.0	11.0
28. **Cyclone Tempering Air, °F**	700	700	700	700
29. **Coal Mill Inlet Temperature, °F**	470	490	480	440
30. **Coal Feed Rate Integrator** **t = 0 minutes** **t = 5 minutes** **Δ x .01 x 12 = tons/hr**	599867 @ 0930 Hrs – –	– – –	602386 @ 1206 Hrs – –	603367 @ 1306 Hrs – –
31. **Clinker Belt Scale Integrator** **t = 0 minutes** **t = 5 minutes** **Δ x .1 x 12 = tons/hr**	– – 35	– – 30	– – 30	– – 35
32. **Kiln Feeder Revs Integrator** **t = 0 minutes** **t = 5 minutes** **(Δ/5 = rpm)**	– – 15.0	– – 13.6	– – 14.8	– – 15.2
33. **Feed Type**	II	II	II	II
34. **Observations**				

O.O.S - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 9/28/83

Engineer LL, RCB

1. Test Number	9/28-5	9/28-6		
2. Time	1410	1520		
3. Baghouse Inlet Temp., °F	–	–		
4. Baghouse ΔP, "H_2O	–	–		
5. Multiclone Inlet Temp., °F	620	640		
6. Kiln ID Fan Damper Position (% open)	59	59		
7. Oxygen, %	1.0	1.8		
8. Combustibles/CO_2, %	0/32.4	0/32.0		
9. Kiln Chain Temp., °F	1300	1300		
10. Kiln End Housing Pressure, in H_2O	-.65	-.65		
11. Kiln Speed, revs/hr (rph)	77	78		
12. Kiln Feeder Speed, revs/min (rpm)	16	16		
13. CO, ppm	0	0		
14. NO_x, ppm	1325	1200		
15. Kiln Shell Temp, °F (highest reading)	540	560		
16. Kiln Feed Bin Level (feet down from bin top)	5-10	5-10		

[illegible]

	5	6		
17. Kiln Load, amps	220-280	220		
18. Kiln Hood Pressure, in H_2O	-.12	-.12		
19. Cooler Air Temp., °F	1620	1620		
20. Cooler Speed, revs/min (rpm)	13	13		
21. Cooler Undergrate Temperature, °F	O.O.S	O.O.S		
22. Cooler Undergrate Pressure, in H_2O	4.2	4.2		
23. Material Temperature, °F	2560	2520		
24. Coal Mill Motor Amps	30	30		
25. Coal Mill Inlet Pressure, in H_2O	-3.4	-3.6		
26. Coal Mill Outlet Pressure, in H_2O	+18.3	+18.3		
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11	11		
28. Cyclone Tempering Air, °F	700	700		
29. Coal Mill Inlet Temperature, °F	435	450		
30. Coal Feed Rate Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .01 x 12 = tons/hr**	604455 @ 1413 HRS – –	605650 @ 1527 Hrs – –		
31. Clinker Belt Scale Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .1 x 12 = tons/hr**	490525 @ 1412 HRS – –	491075 @ 1585 HRS – –		
32. Kiln Feeder Revs Integrator **t = 0 minutes** **t = 5 minutes** **(Δ/5 = rpm)**	– – –	– – –		
33. Feed Type	II	II		
34. Observations				

O.O.S - out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 9/29/83

Engineer LL

1. Test Number	9/29-1	9/29-2	9/29-3	
2. Time	1100	1205	1405	
3. Baghouse Inlet Temp., °F	—	—	—	
4. Baghouse ΔP, "H_2O	—	—	—	
5. Multiclone Inlet Temp., °F	630	640	605	
6. Kiln ID Fan Damper Position (% open)	61	61	61	
7. Oxygen, %	2.3 ± .5	1.0 ± .3	2.0 ± .5	
8. Combustibles/CO_2, %	0/29.6	0/32.0	0/29.2	
9. Kiln Chain Temp., °F	1280	1310	1260	
10. Kiln End Housing Pressure, in H_2O	-.70	-.75	-.68	
11. Kiln Speed, revs/hr (rph)	75	60	76	
12. Kiln Feeder Speed, revs/min (rpm)	15.8	12.3	16.0	
13. CO, ppm	0	0	0	
14. NO_x, ppm	1300 ± 100	700	1250 ± 250	
15. Kiln Shell Temp, °F (highest reading)	—	—	—	
16. Kiln Feed Bin Level (feet down from bin top)	—	—	—	

9/29/83

	1	2	3	
17. Kiln Load, amps	250-300	220-240	300-350	
18. Kiln Hood Pressure, in H_2O	-.08	-.15	-.5	
19. Cooler Air Temp., °F	1550	1600	1600	
20. Cooler Speed, revs/min (rpm)	10	10	10	
21. Cooler Undergrate Temperature, °F	O.O.S.	O.O.S.	O.O.S.	
22. Cooler Undergrate Pressure, in H_2O	4.2±.2	4.0	3.9	
23. Material Temperature, °F	2520	2320	2520	
24. Coal Mill Motor Amps	29.5	29.5	29.5	
25. Coal Mill Inlet Pressure, in H_2O	-3.7	-3.5	-3.6	
26. Coal Mill Outlet Pressure, in H_2O	+18.5	+18.5	+18.0	
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	10	11	11	
28. Cyclone Tempering Air, °F	700	700	700	
29. Coal Mill Inlet Temperature, °F	450	460	470	
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	624799 @ 1115 HRS – –	625743 @ 1215 HRS – –	301700 @ 1315 HRS – –	
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	– – 35	– – 35-40	– – 35	
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	– – 13.4	– – 11.8	– – 16.0	
33. Feed Type	II	II	II	
34. Observations				

O.O.S. - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 9/30/83

Engineer LL

1. Test Number	9/30-1	9/30-2	9/30-3	9/30-4
2. Time	0945	1105	1205	1325
3. Baghouse Inlet Temp., °F	—	—	—	—
4. Baghouse ΔP, "H_2O	—	—	—	—
5. Multiclone Inlet Temp., °F	620	615	620	620
6. Kiln ID Fan Damper Position (% open)	61	61	62	62
7. Oxygen, %	2.0 ± 1.0	1.6 ± 1.0	2.3 ± .5	2.7 ± .5
8. Combustibles/CO_2, %	0/30.0	0/30.4	0/30.4	0/30.0
9. Kiln Chain Temp., °F	1260	1290	1290	1290
10. Kiln End Housing Pressure, in H_2O	-.75	-.70	-.71	-.69
11. Kiln Speed, revs/hr (rph)	66	60	61	66
12. Kiln Feeder Speed, revs/min (rpm)	13.7	12.1	12.5	13.6
13. CO, ppm	0	0	0	0
14. NO_x, ppm	1200 ± 500	750 ± 25	1000	1200
15. Kiln Shell Temp, °F (highest reading)	—	—	—	—
16. Kiln Feed Bin Level (feet down from bin top)	—	—	—	—

11/30/83

	1	2	3	4
17. **Kiln Load, amps**	250-280	230-250	200-240	210-240
18. **Kiln Hood Pressure, in H_2O**	-.10	-.13	-.10	-.13
19. **Cooler Air Temp., °F**	1710	1830	1770	1700
20. **Cooler Speed, revs/min (rpm)**	13	13	13	12.5
21. **Cooler Undergrate Temperature, °F**	O.O.S.	O.O.S.	O.O.S.	O.O.S.
22. **Cooler Undergrate Pressure, in H_2O**	4.2	5.5	5.0	4.8
23. **Material Temperature, °F**	2500	2350	2400	2470
24. **Coal Mill Motor Amps**	30	30	30	30
25. **Coal Mill Inlet Pressure, in H_2O**	-3.5	-3.6	-3.6	-3.7
26. **Coal Mill Outlet Pressure, in H_2O**	+18.5	+18.5	+18.5	+18.0
27. **Coal Mill Feed Rate, (% scale x 15 tons/hr)**	11.8	11.8	11.8	11.9
28. **Cyclone Tempering Air, °F**	700	700	700	700
29. **Coal Mill Inlet Temperature, °F**	430	440	480	480
30. **Coal Feed Rate Integrator** **t = 0 minutes** **t = 5 minutes** **Δ x .01 x 12 = tons/hr**	645951 @ 0952 Hrs – –	647160 @ 1110 Hrs – –	648072 @ 1208 Hrs – –	649355 @ 1230 Hrs – –
31. **Clinker Belt Scale Integrator** **t = 0 minutes** **t = 5 minutes** **Δ x .1 x 12 = tons/hr**	– – 35-37	– – 40-45	– – 45	– – 33
32. **Kiln Feeder Revs Integrator** **t = 0 minutes** **t = 5 minutes** **(Δ/5 = rpm)**	– – 13	– – 11.6	– – 11.8	– – 12.8
33. **Feed Type**	II	II	II	II
34. **Observations**				

O.O.S. - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 9/30/83

Engineer LL

1. Test Number	9/30-5			
2. Time	1440			
3. Baghouse Inlet Temp., °F	—			
4. Baghouse ΔP, "H_2O	—			
5. Multiclone Inlet Temp., °F	640			
6. Kiln ID Fan Damper Position (% open)	62			
7. Oxygen, %	2.7±.5			
8. Combustibles/CO_2, %	0/30.0			
9. Kiln Chain Temp., °F	1305			
10. Kiln End Housing Pressure, in H_2O	-.72			
11. Kiln Speed, revs/hr (rph)	60			
12. Kiln Feeder Speed, revs/min (rpm)	12.5			
13. CO, ppm	0			
14. NO_x, ppm	800			
15. Kiln Shell Temp, °F (highest reading)	—			
16. Kiln Feed Bin Level (feet down from bin top)	—			

	5			
17. **Kiln Load, amps**	190-200			
18. **Kiln Hood Pressure, in H_2O**	-.10			
19. **Cooler Air Temp., °F**	1680			
20. **Cooler Speed, revs/min (rpm)**	12.6			
21. **Cooler Undergrate Temperature, °F**	O.O.S.			
22. **Cooler Undergrate Pressure, in H_2O**	4.8			
23. **Material Temperature, °F**	2370			
24. **Coal Mill Motor Amps**	29.5			
25. **Coal Mill Inlet Pressure, in H_2O**	-3.9			
26. **Coal Mill Outlet Pressure, in H_2O**	+18.0			
27. **Coal Mill Feed Rate, (% scale x 15 tons/hr)**	10.5			
28. **Cyclone Tempering Air, °F**	700			
29. **Coal Mill Inlet Temperature, °F**	470			
30. **Coal Feed Rate Integrator** **t = 0 minutes** **t = 5 minutes** **Δ x .01 x 12 = tons/hr**	650477 @ 1443 HRS – –			
31. **Clinker Belt Scale Integrator** **t = 0 minutes** **t = 5 minutes** **Δ x .1 x 12 = tons/hr**	– – 92			
32. **Kiln Feeder Revs Integrator** **t = 0 minutes** **t = 5 minutes** **(Δ/5 = rpm)**	– – 11.8			
33. **Feed Type**	II	II		
34. **Observations**				

O.O.S. - out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/3/83

Engineer RCB

1. **Test Number**	10/3-1	10/3-2	10/3-3	10/3-4
2. **Time**	0910	1115	1300	1512
3. **Baghouse Inlet Temp., °F**	–	–	–	–
4. **Baghouse ΔP, "H_2O**	–	–	–	–
5. **Multiclone Inlet Temp., °F**	590	610	610	600
6. **Kiln ID Fan Damper Position (% open)**	59	59	59	59
7. **Oxygen, %**	2.7	2.8–.8	1.3-2.2	1.4
8. **Combustibles/CO_2, %**	0/29.2	0/30.8	0/31.2	0/31.2
9. **Kiln Chain Temp., °F**	1260	1260	1280	1260
10. **Kiln End Housing Pressure, in H_2O**	-.65	-.65	-.7	-.68
11. **Kiln Speed, revs/hr (rph)**	66	68	66	72
12. **Kiln Feeder Speed, revs/min (rpm)**	14	14	14	15
13. **CO, ppm**	0	0	0	0
14. **NO_x, ppm**	1425	1200-1250	1375	1200
15. **Kiln Shell Temp, °F (highest reading)**	460	600	300	480
16. **Kiln Feed Bin Level (feet down from bin top)**	6-11	6-11	9-11	6-10

10/5/83

	1	2	3	4
17. Kiln Load, amps	220	220	200-220	220-280
18. Kiln Hood Pressure, in H_2O	-.12	-.09	-.10	-.12
19. Cooler Air Temp., °F	1580	1620	1650	1650
20. Cooler Speed, revs/min (rpm)	12.5-13	13	13	13
21. Cooler Undergrate Temperature, °F	O.O.S	O.O.S	O.O.S	O.O.S
22. Cooler Undergrate Pressure, in H_2O	4.4	4.6	4.5	4.6
23. Material Temperature, °F	2500	2480	2540	2500
24. Coal Mill Motor Amps	30	30	30	30
25. Coal Mill Inlet Pressure, in H_2O	-3.6	-3.4	-3.4	-3.4
26. Coal Mill Outlet Pressure, in H_2O	+17.5	+18.0	+18.0	+18.3
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11	11	11	11
28. Cyclone Tempering Air, °F	720	700	700	700
29. Coal Mill Inlet Temperature, °F	500	430	410	440
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	710570 @ 0915 Hrs =	712506 @ 1119 Hrs – –	714092 @ 1301 Hrs =	716215 @ 1517 Hrs =
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	541344 @ 0913 Hrs =	542314 @ 1117 Hrs =	543070 @ 1300 Hrs	544075 @ 1517 Hrs =
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	– – –	– – –	– – –	– – –
33. Feed Type	II	II	II	II
34. Observations				

O.O.S. - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/4/83

Engineer LL

1. Test Number	10/4-1	10/4-2	10/4-3	10/4-4
2. Time	0910	1000	1150	1320
3. Baghouse Inlet Temp., °F	—	—	—	—
4. Baghouse ΔP, "H_2O	—	—	—	—
5. Multiclone Inlet Temp., °F	580	620	580	610
6. Kiln ID Fan Damper Position (% open)	63	65	63	65
7. Oxygen, %	2.0± .7	1.5	2.3± .5	1.6± .8
8. Combustibles/CO_2, %	0/30.4	0/34.0	0/29.6	0/32.8
9. Kiln Chain Temp., °F	1270	1300	1240	1290
10. Kiln End Housing Pressure, in H_2O	-.80	-.80	-.80	-.82
11. Kiln Speed, revs/hr (rph)	71	50	72	46
12. Kiln Feeder Speed, revs/min (rpm)	14.5	10.2	15.0	9.2
13. CO, ppm	0	0	0	0
14. NO_x, ppm	1750	750	1750	400
15. Kiln Shell Temp, °F (highest reading)	—	—	540	—
16. Kiln Feed Bin Level (feet down from bin top)	-	—	—	—

10/7/83

	1	2	3	4
17. **Kiln Load, amps**	320-360	180-220	320	150-170
18. **Kiln Hood Pressure, in H_2O**	-.12	-.12	-.12	-.06
19. **Cooler Air Temp., °F**	1150	1730	1720	1630
20. **Cooler Speed, revs/min (rpm)**	12.5	12.7	13.5	13.5
21. **Cooler Undergrate Temperature, °F**	O.O.S.	O.O.S.	O.O.S.	O.O.S.
22. **Cooler Undergrate Pressure, in H_2O**	4.0	5.3	4.6	4.5
23. **Material Temperature, °F**	2620	2320	2560	1900
24. **Coal Mill Motor Amps**	30	30	30	30
25. **Coal Mill Inlet Pressure, in H_2O**	-3.2	-3.0	-3.4	-3.5
26. **Coal Mill Outlet Pressure, in H_2O**	+18.0	+18.5	+17.5	+18.0
27. **Coal Mill Feed Rate, (% scale x 15 tons/hr)**	11	11	11	10.4
28. **Cyclone Tempering Air, °F**	700	700	700	700
29. **Coal Mill Inlet Temperature, °F**	500±30	450	540	530
30. **Coal Feed Rate Integrator** t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	732766 @ 0920 HRS – –	733441 @ 1007 HRS – –	735278 @ 1201 HRS – –	736530 @ 1320 HRS – –
31. **Clinker Belt Scale Integrator** t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	O.O.S.	O.O.S.	O.O.S.	O.O.S.
32. **Kiln Feeder Revs Integrator** t = 0 minutes t = 5 minutes (Δ/5 = rpm)	– – 14.0	– – 9.6	– – 13.2	– – –
33. **Feed Type**	II	II	II	II
34. **Observations**	recovering from upset	big fluctuations	ring buildup	in the [illegible]

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/5/83

Engineer RCB

1. Test Number	10/5-1	10/5-2	10/5-3	10/5-4
2. Time	0845	1100	1250	1450
3. Baghouse Inlet Temp., °F	—	—	—	—
4. Baghouse ΔP, "H_2O	—	—	—	-
5. Multiclone Inlet Temp., °F	560	600	—	580
6. Kiln ID Fan Damper Position (% open)	62	62	62	62
7. Oxygen, %	1.3-2.0	.4-.8	1.0-1.8	.8-2.2
8. Combustibles/CO_2, %	0/29.6	spikes/29.6	0/32.0	0/32.0
9. Kiln Chain Temp., °F	1260	1280	1260	1260
10. Kiln End Housing Pressure, in H_2O	-.80	-.75	-.75	-.75
11. Kiln Speed, revs/hr (rph)	68	64	72	66
12. Kiln Feeder Speed, revs/min (rpm)	14.0	13.0	15.0	13.5
13. CO, ppm	0	spikes	0	0
14. NO_x, ppm	1000-1250 in 5 minutes	700	1375	800
15. Kiln Shell Temp, °F (highest reading)	640	640	600	250
16. Kiln Feed Bin Level (feet down from bin top)	9-10	4-8	8	5-8

	1	2	3	4
17. Kiln Load, amps	280-320	240-300	280-340	270-290
18. Kiln Hood Pressure, in H_2O	-.11	-.10	-.12	-.10
19. Cooler Air Temp., °F	1600	1720	1650	1700
20. Cooler Speed, revs/min (rpm)	13.5	13.5	12.5-13.0	13.5
21. Cooler Undergrate Temperature, °F	O.O.S	O.O.S	O.O.S	O.O.S
22. Cooler Undergrate Pressure, in H_2O	4.2	4.4	4.2	4.8
23. Material Temperature, °F	2520	2540	2600	2440
24. Coal Mill Motor Amps	90	90	90	90
25. Coal Mill Inlet Pressure, in H_2O	-2.2	-2.2	-2.3	-2.4
26. Coal Mill Outlet Pressure, in H_2O	+18.0	+18.0	+18.0	+18.0
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11.0	11.4	11.4	11.0
28. Cyclone Tempering Air, °F	700	700	700	700
29. Coal Mill Inlet Temperature, °F	450	420	480	480
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	754490 @ 0855 Hrs — —	756490 @ 1107 Hrs — —	758146 @ 1253 Hrs — —	760040 @ 1455 Hrs — —
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	off Line	off Line	off Line	off Line
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	— — —	— — —	— — —	— — —
33. Feed Type	II	II	II	II
34. Observations	Kiln cycling since yesterday afternoon, trying to steady	running lo O_2 from 1000 on		

O.O.S - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/6/83

Engineer ACB, LL

1. Test Number	10/6-1	10/6-2		
2. Time	0850	0955		
3. Baghouse Inlet Temp., °F	—	—		
4. Baghouse ΔP, "H_2O	—	—		
5. Multiclone Inlet Temp., °F	540	580		
6. Kiln ID Fan Damper Position (% open)	66	68		
7. Oxygen, %	0	1.6 ± 1		
8. Combustibles/CO_2, %	0/32.4	0/31.6		
9. Kiln Chain Temp., °F	1280	1290		
10. Kiln End Housing Pressure, in H_2O	-.8	-.8		
11. Kiln Speed, revs/hr (rph)	60	70		
12. Kiln Feeder Speed, revs/min (rpm)	12.5	14.5		
13. CO, ppm	1000	0		
14. NO_x, ppm	850-950	1450		
15. Kiln Shell Temp, °F (highest reading)	460	600		
16. Kiln Feed Bin Level (feet down from bin top)	6-11	6-11		

10/6/83

	1	2		
17. Kiln Load, amps	240-280	320-340		
18. Kiln Hood Pressure, in H_2O	-.14	-.14		
19. Cooler Air Temp., °F	1700	1690		
20. Cooler Speed, revs/min (rpm)	14	13.5		
21. Cooler Undergrate Temperature, °F	O.O.S	O.O.S		
22. Cooler Undergrate Pressure, in H_2O	5.4	5.2		
23. Material Temperature, °F	1900	2590		
24. Coal Mill Motor Amps	30	30		
25. Coal Mill Inlet Pressure, in H_2O	-2.4	—		
26. Coal Mill Outlet Pressure, in H_2O	+17.8	+18.0		
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11	11.3		
28. Cyclone Tempering Air, °F	740	740		
29. Coal Mill Inlet Temperature, °F	470	450		
30. Coal Feed Rate Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .01 x 12 = tons/hr**	776751 @ 0858 Hrs — —	777817 @ 1007 Hrs — —		
31. Clinker Belt Scale Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .1 x 12 = tons/hr**	O.O.S	O.O.S		
32. Kiln Feeder Revs Integrator **t = 0 minutes** **t = 5 minutes** **(Δ/5 = rpm)**	— — —	— — 19.8		
33. Feed Type	II	II		
34. Observations				

O.O.S - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/7/89

Engineer LL

1. Test Number	10/7-1	10/7-2		
2. Time	1140	1405		
3. Baghouse Inlet Temp., °F	–	–		
4. Baghouse ΔP, "H_2O	–	–		
5. Multiclone Inlet Temp., °F	540	545		
6. Kiln ID Fan Damper Position (% open)	55	60		
7. Oxygen, %	0	3.1±.5		
8. Combustibles/CO_2, %	0/32.8	0/30.8		
9. Kiln Chain Temp., °F	1180	1210		
10. Kiln End Housing Pressure, in H_2O	-.60	-.65		
11. Kiln Speed, revs/hr (rph)	82	70		
12. Kiln Feeder Speed, revs/min (rpm)	16.5	14.5		
13. CO, ppm	0	0		
14. NO_x, ppm	1600	800		
15. Kiln Shell Temp, °F (highest reading)	600	520		
16. Kiln Feed Bin Level (feet down from bin top)	—	—		

	1	2		
17. Kiln Load, amps	310	250-260		
18. Kiln Hood Pressure, in H_2O	-.1	-.14		
19. Cooler Air Temp., °F	1750	1530		
20. Cooler Speed, revs/min (rpm)	14.0	10.5		
21. Cooler Undergrate Temperature, °F	O.O.S.	O.O.S.		
22. Cooler Undergrate Pressure, in H_2O	5.2	5.2		
23. Material Temperature, °F	2600	2450		
24. Coal Mill Motor Amps	30	30		
25. Coal Mill Inlet Pressure, in H_2O	-	-		
26. Coal Mill Outlet Pressure, in H_2O	+18.5	+18.5		
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	10.0	9.8		
28. Cyclone Tempering Air, °F	680	730		
29. Coal Mill Inlet Temperature, °F	430	485		
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	798720 @ 1145HRS – –	800810 @ 1410HRS – –		
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	O.O.S.	O.O.S.		
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	– – 16.0	– – –		
33. Feed Type	II	II		
34. Observations				

O.O.S. - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/10/83

Engineer ACB

1. Test Number	10/10-1	10/10-2	10/10-3	10/10-4
2. Time	0845	1030	1310	1455
3. Baghouse Inlet Temp., °F	–	–	–	–
4. Baghouse ΔP, "H_2O	–	–	–	–
5. Multiclone Inlet Temp., °F	480	500	520	520
6. Kiln ID Fan Damper Position (% open)	60	58	58	58
7. Oxygen, %	2.7-3.3	1.5-2.0	1.2-1.7	2.0-3.0
8. Combustibles/CO_2, %	0/27.2	0/32.0	0/32.0	0/28.8
9. Kiln Chain Temp., °F	1180	1240	1220	1200
10. Kiln End Housing Pressure, in H_2O	-.82	-.85	-.77	-.80
11. Kiln Speed, revs/hr (rph)	74	52	56	62
12. Kiln Feeder Speed, revs/min (rpm)	13	10	11.5	12.5
13. CO, ppm	0	0	0	0
14. NO_x, ppm	950	600	1150	1250
15. Kiln Shell Temp, °F (highest reading)	–	–	–	650
16. Kiln Feed Bin Level (feet down from bin top)	6-12	5-10	6-11	4-11

10/10/83

	1	2	3	4
17. Kiln Load, amps	280-300	200-240	200-240	280-300
18. Kiln Hood Pressure, in H_2O	-.05	-.08-.10	-1.2	-1.0
19. Cooler Air Temp., °F	1500	1600	1620	1600
20. Cooler Speed, revs/min (rpm)	15.0	14.5	14.5	15.0
21. Cooler Undergrate Temperature, °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
22. Cooler Undergrate Pressure, in H_2O	4.2	6.2	5.6	4.2
23. Material Temperature, °F	2500	2340	2440	2540
24. Coal Mill Motor Amps	30	30	30	30
25. Coal Mill Inlet Pressure, in H_2O	-1.9	-1.9	-1.9	-2.0
26. Coal Mill Outlet Pressure, in H_2O	+18.5	+19.0	+19.3	+17.5
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	10	10	10	10
28. Cyclone Tempering Air, °F	690	690	680	690
29. Coal Mill Inlet Temperature, °F	540	480	460	530
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	845049 @ 0848 Hrs — —	846638 @ 1035 Hrs — —	848974 @ 1312 Hrs — —	850545 @ 1458 Hrs — —
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	O.O.S	O.O.S	O.O.S	O.O.S
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	— — —	— — —	— — —	— — —
33. Feed Type	II	II	II	II
34. Observations				

O.O.S. - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/11/83

Engineer RCB

1. Test Number	10/11-1	10/11-2	10/11-3	10/11-4
2. Time	0840	1000	1230	1430
3. Baghouse Inlet Temp., °F	–	–	–	–
4. Baghouse ΔP, "H_2O	–	–	–	–
5. Multiclone Inlet Temp., °F	490	560	580	580
6. Kiln ID Fan Damper Position (% open)	60	58	58	58
7. Oxygen, %	1.8-2.7	2.3	3.5	3.9
8. Combustibles/CO_2, %	0/28.8	0/31.2	0/28.0	0/26.4
9. Kiln Chain Temp., °F	1200	1260	1260	1240
10. Kiln End Housing Pressure, in H_2O	-.80	-.80	-.70	-.75
11. Kiln Speed, revs/hr (rph)	66	58	58	58
12. Kiln Feeder Speed, revs/min (rpm)	13.5	12.0	12.0	12.0
13. CO, ppm	0	0	0	0
14. NO_x, ppm	1500	950	1050	950
15. Kiln Shell Temp, °F (highest reading)	—	—	—	—
16. Kiln Feed Bin Level (feet down from bin top)	5-10	5-10	5-10	5-10

10/11/83

	1	2	3	4
17. Kiln Load, amps	280-300	260	220-240	220-240
18. Kiln Hood Pressure, in H_2O	-.08	-.16	-.13	-.15
19. Cooler Air Temp., °F	1600	1650	1650	1500
20. Cooler Speed, revs/min (rpm)	14	14	14	14
21. Cooler Undergrate Temperature, °F	O.O.S	O.O.S	O.O.S	O.O.S
22. Cooler Undergrate Pressure, in H_2O	4.7	5.2	4.7	4.2
23. Material Temperature, °F	2520	2440	2480	2480
24. Coal Mill Motor Amps	30	30	30	30
25. Coal Mill Inlet Pressure, in H_2O	-1.9	-2.1	-2.1	-2.1
26. Coal Mill Outlet Pressure, in H_2O	+19.0	+19.0	+19.0	+18.8
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	10	10	10	10
28. Cyclone Tempering Air, °F	700	700	700	700
29. Coal Mill Inlet Temperature, °F	480	500	470	510
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	866425 @ 0844 Hrs – –	867634 @ 1003 Hrs – –	869872 @ 1236 Hrs – –	871717 @ 1440 Hrs – –
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	556100 @ 0841 Hrs – –	556846 @ 1004 Hrs	557914 @ 1234 Hrs – –	558726 @ 1439 Hrs – –
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	812710 @ 0842 Hrs – –	813700 @ 1004 Hrs – –	815325 @ 1235 Hrs – –	– – –
33. Feed Type	II	II	II	II
34. Observations				

O.O.S.- Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/11/83

Engineer RCB

1. Test Number	10/11-5			
2. Time	1530			
3. Baghouse Inlet Temp., °F	–			
4. Baghouse ΔP, "H_2O	–			
5. Multiclone Inlet Temp., °F	580			
6. Kiln ID Fan Damper Position (% open)	58			
7. Oxygen, %	3.5			
8. Combustibles/CO_2, %	0/27.4			
9. Kiln Chain Temp., °F	1260			
10. Kiln End Housing Pressure, in H_2O	-.70			
11. Kiln Speed, revs/hr (rph)	60			
12. Kiln Feeder Speed, revs/min (rpm)	12.5			
13. CO, ppm	0			
14. NO_x, ppm	1050			
15. Kiln Shell Temp, °F (highest reading)	—			
16. Kiln Feed Bin Level (feet down from bin top)	5-10			

10/11/83

	5			
17. Kiln Load, amps	220-260			
18. Kiln Hood Pressure, in H_2O	-.15			
19. Cooler Air Temp., °F	1500			
20. Cooler Speed, revs/min (rpm)	14			
21. Cooler Undergrate Temperature, °F	0.0.S			
22. Cooler Undergrate Pressure, in H_2O	4.4			
23. Material Temperature, °F	2520			
24. Coal Mill Motor Amps	30.0			
25. Coal Mill Inlet Pressure, in H_2O	-2.1			
26. Coal Mill Outlet Pressure, in H_2O	+18.8			
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	10			
28. Cyclone Tempering Air, °F	700			
29. Coal Mill Inlet Temperature, °F	490			
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	872507 @ 1533 Hrs =			
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	559032 @ 1532 Hrs =			
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	817350 @ 1539 Hrs =			
33. Feed Type	II			
34. Observations				

O.O.S. - out of Srevice

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/12/83

Engineer ACB, LL

1. Test Number	10/12-1	10/12-2		
2. Time	0900	1100		
3. Baghouse Inlet Temp., °F	—	—		
4. Baghouse ΔP, "H_2O	—	—		
5. Multiclone Inlet Temp., °F	—	—		
6. Kiln ID Fan Damper Position (% open)	58	50		
7. Oxygen, %	.7	2.6		
8. Combustibles/CO_2, %	0/31.2	0/23.5		
9. Kiln Chain Temp., °F	1200	1300		
10. Kiln End Housing Pressure, in H_2O	-.85	-.45		
11. Kiln Speed, revs/hr (rph)	72	26		
12. Kiln Feeder Speed, revs/min (rpm)	15	5		
13. CO, ppm	0	0		
14. NO_x, ppm	1850	500		
15. Kiln Shell Temp, °F (highest reading)	—	—		
16. Kiln Feed Bin Level (feet down from bin top)	5-11	5-7		

10/12/83

	1	2		
17. Kiln Load, amps	900	120		
18. Kiln Hood Pressure, in H_2O	-.09	-.08		
19. Cooler Air Temp., °F	1650	1150		
20. Cooler Speed, revs/min (rpm)	14	11		
21. Cooler Undergrate Temperature, °F	0.0.S	0.0.S		
22. Cooler Undergrate Pressure, in H_2O	5.4	1.2		
23. Material Temperature, °F	2580	1900		
24. Coal Mill Motor Amps	90	30		
25. Coal Mill Inlet Pressure, in H_2O	-1.9	-2.5		
26. Coal Mill Outlet Pressure, in H_2O	+18.8	+22.5		
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	10	0		
28. Cyclone Tempering Air, °F	700	700		
29. Coal Mill Inlet Temperature, °F	480-500	250		
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	008275 @ 0922 Hrs - -	- - -		
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	566137 @ 0911 Hrs =	566960 @ 1100 Hrs		
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	- - -	- - -		
33. Feed Type	II	II		
34. Observations				

O.O.S. - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/13/83

Engineer RCB, LL

1. Test Number	10/13-1	10/13-2	10/13-3	10/13-4
2. Time	0800	0905	1000	1100
3. Baghouse Inlet Temp., °F	–	–	–	–
4. Baghouse ΔP, "H_2O	–	–	–	–
5. Multiclone Inlet Temp., °F	530	530	520	520
6. Kiln ID Fan Damper Position (% open)	60	60	60	60
7. Oxygen, %	1.4± 1.0	1.2±.5	1.8± .8	1.7± .5
8. Combustibles/CO_2, %	0/32.0	0/32.0	0/30.4	0/31.6
9. Kiln Chain Temp., °F	1190	1180	1200	1220
10. Kiln End Housing Pressure, in H_2O	−.56	−.55	−.65	−.66
11. Kiln Speed, revs/hr (rph)	64	61	62	61
12. Kiln Feeder Speed, revs/min (rpm)	13.0	12.5	12.5	12.5
13. CO, ppm	(some spikes) 0	0	(some spikes) 0	0
14. NO_x, ppm	1400±50	1125	850	800
15. Kiln Shell Temp, °F (highest reading)	300	300	200	~400
16. Kiln Feed Bin Level (feet down from bin top)	—	—	—	—

10/19/83

	1	2	3	4
17. Kiln Load, amps	200-210	190-200	190-200	190
18. Kiln Hood Pressure, in H_2O	-.08	-.07	-.12	-.12
19. Cooler Air Temp., °F	1670	1710	1670	1650
20. Cooler Speed, revs/min (rpm)	15.3	15.3	15.5	15.3
21. Cooler Undergrate Temperature, °F	0.0.S	0.0.S	0.0.S	0.0.S
22. Cooler Undergrate Pressure, in H_2O	4.7	5.1	4.8	4.5
23. Material Temperature, °F	2540	2480	2460	2450
24. Coal Mill Motor Amps	30	30	30	30
25. Coal Mill Inlet Pressure, in H_2O	- .2	- .2	- .2	- .2
26. Coal Mill Outlet Pressure, in H_2O	+18.75	+18.75	+18.75	+18.75
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	10	10	10	10
28. Cyclone Tempering Air, °F	700	700	700	700
29. Coal Mill Inlet Temperature, °F	510	530	510	510
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	906915 @ 0806 Hrs – –	907858 @ 0909 Hrs – –	908780 @ 1007 Hrs – –	909485 @ 1058 Hrs. – –
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	– – 32	– – 37	575839 @ 1015 Hrs – –	– – 32
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	– – 12.4	– – 12	– – –	– – 11.8
33. Feed Type	II	II.	II	II
34. Observations				

O.O.S - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/13/83

Engineer LL

1. Test Number	10/13-5	10/13-6	10/13-7	
2. Time	1300	1400	1500	
3. Baghouse Inlet Temp., °F	–	–	–	
4. Baghouse ΔP, "H_2O	–	–	-	
5. Multiclone Inlet Temp., °F	530	520	520	
6. Kiln ID Fan Damper Position (% open)	60	60	60	
7. Oxygen, %	1.4±.6	3.0±.5	3.0±.5	
8. Combustibles/CO_2, %	0/32.0	0/29.2	0/29.2	
9. Kiln Chain Temp., °F	1210	1200	1200	
10. Kiln End Housing Pressure, in H_2O	-.70	-.71	-.75	
11. Kiln Speed, revs/hr (rph)	67	62	64	
12. Kiln Feeder Speed, revs/min (rpm)	14.2	13.0	13.5	
13. CO, ppm	0	0	0	
14. NO_x, ppm	1300	850	700	
15. Kiln Shell Temp, °F (highest reading)	400	350	400	
16. Kiln Feed Bin Level (feet down from bin top)	–	–	–	

10/13/83

	5	6	7	
17. Kiln Load, amps	210-230	190-200	200-220	
18. Kiln Hood Pressure, in H_2O	-.09	-.15	-.16	
19. Cooler Air Temp., °F	1650	1610	1620	
20. Cooler Speed, revs/min (rpm)	15.4	15.5	15.4	
21. Cooler Undergrate Temperature, °F	O.O.S	O.O.S	O.O.S	
22. Cooler Undergrate Pressure, in H_2O	4.6	4.2	4.3	
23. Material Temperature, °F	2530	2440	2440	
24. Coal Mill Motor Amps	30	30	30	
25. Coal Mill Inlet Pressure, in H_2O	- .1	- .6	- .4	
26. Coal Mill Outlet Pressure, in H_2O	+18.7	+18.5	+18.8	
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	10	10	10	
28. Cyclone Tempering Air, °F	690	700	700	
29. Coal Mill Inlet Temperature, °F	460	480	490	
30. Coal Feed Rate Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .01 x 12 = tons/hr**	911348 @ 1305 Hrs – –	912259 @ 1404 Hrs – –	913111 @ 1503 Hrs – –	
31. Clinker Belt Scale Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .1 x 12 = tons/hr**	– – 35-37	– – 25-30	– – 34	
32. Kiln Feeder Revs Integrator **t = 0 minutes** **t = 5 minutes** **(Δ/5 = rpm)**	– – 13.4	– – 12.2	– – 13.4	
33. Feed Type	II	II	II	
34. Observations				

O.O.S.- Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/14/83

Engineer LL, RCB

1. Test Number	10/14-1	10/14-2	10/14-3	10/14-4
2. Time	0815	1015	1300	1515
3. Baghouse Inlet Temp., °F	—	—	—	—
4. Baghouse ΔP, "H_2O	—	—	—	—
5. Multiclone Inlet Temp., °F	500	500	530	570
6. Kiln ID Fan Damper Position (% open)	60	60	60	60
7. Oxygen, %	1.3 ± 1.0	1.0 ± .2	2.5	2.7 ± .5
8. Combustibles/CO_2, %	0/31.6	0/23.6	0/29.6	0/30.0
9. Kiln Chain Temp., °F	1220	1200	1200	1320
10. Kiln End Housing Pressure, in H_2O	-.74	-.75	-.75	-.85
11. Kiln Speed, revs/hr (rph)	64	74	67	42
12. Kiln Feeder Speed, revs/min (rpm)	13.3	15.5	13.9	8.5
13. CO, ppm	0	spikes	0	0
14. NO_x, ppm	950	860	925	450
15. Kiln Shell Temp, °F (highest reading)	325	400	200	420
16. Kiln Feed Bin Level (feet down from bin top)	—	—	—	—

10/14/83

	1	2	3	4
17. Kiln Load, amps	210-220	220-250	260-280	120-160
18. Kiln Hood Pressure, in H_2O	-.10	-.10	-.16	-.17
19. Cooler Air Temp., °F	1650	1630	1480	1100-1700
20. Cooler Speed, revs/min (rpm)	13	13	9.7	10.5
21. Cooler Undergrate Temperature, °F	O.O.S	O.O.S	O.O.S	O.O.S
22. Cooler Undergrate Pressure, in H_2O	3.7	5.3	3.4	3.7
23. Material Temperature, °F	2460	2400	2460	1900
24. Coal Mill Motor Amps	30	30	30	30
25. Coal Mill Inlet Pressure, in H_2O	-2.0	-2.0	-2.1	-2.0
26. Coal Mill Outlet Pressure, in H_2O	+19.0	+18.8	+18.5	+18.5
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	10	10	10	9.8
28. Cyclone Tempering Air, °F	700	700	700	720
29. Coal Mill Inlet Temperature, °F	510	450-500	530	500-540
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	928835 @ 0840 Hrs – –	930404 @ 1026 Hrs – –	930851 @ 1310 Hrs – –	934898 @ 1330 Hrs
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	O.O.S	O.O.S	O.O.S	O.O.S
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	– – 13.2	– – 13.6	– – 13.0	– – –
33. Feed Type	II	II	II	II
34. Observations				

O.O.S. - Out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/24/83

Engineer RCB

1. Test Number	10/24-1	10/24-2	10/24-3	
2. Time	0850	1045	1300	
3. Baghouse Inlet Temp., °F	350	340	Kiln in the hole	
4. Baghouse ΔP, "H_2O	5.1	5.6	"	
5. Multiclone Inlet Temp., °F	700	690	670	
6. Kiln ID Fan Damper Position (% open)	58	58	58	
7. Oxygen, %	1.5±.9	.6±2.1	1.5±.7	
8. Combustibles/CO_2, %	0/32.8	0/32.0	0/33.6	
9. Kiln Chain Temp., °F	1360	1350	1360	
10. Kiln End Housing Pressure, in H_2O	-.60	-.60	-.60	
11. Kiln Speed, revs/hr (rph)	72-70	72	68	
12. Kiln Feeder Speed, revs/min (rpm)	14.0	14.5	13.5	
13. CO, ppm	0	0	0	
14. NO_x, ppm	700-1100	1000-1500	400	
15. Kiln Shell Temp, °F (highest reading)	420	450	350	
16. Kiln Feed Bin Level (feet down from bin top)	—	—	—	

10/24/83

	1	2	3	
17. Kiln Load, amps	150	170	160-190	
18. Kiln Hood Pressure, in H_2O	-.12	-.14	-.22	
19. Cooler Air Temp., °F	1500	1340	1550	
20. Cooler Speed, revs/min (rpm)	15.2	15.2	15.2	
21. Cooler Undergrate Temperature, °F	O.O.S	O.O.S	O.O.S	
22. Cooler Undergrate Pressure, in H_2O	5.2	5.2	5.8	
23. Material Temperature, °F	2300	2460	1940	
24. Coal Mill Motor Amps	30	30	30	
25. Coal Mill Inlet Pressure, in H_2O	-1.85	-2.0	-1.9	
26. Coal Mill Outlet Pressure, in H_2O	+18.3	+18.4	+18.4	
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	10.7	9.8	10.0	
28. Cyclone Tempering Air, °F	700	700	700	
29. Coal Mill Inlet Temperature, °F	530	520	500	
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	- - -	980883 @ 1105 Hrs - -	67374 @ 1316 Hrs - -	
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	O.O.S.	O.O.S.	O.O.S	
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	63549 @ 0901 Hrs 63472 @ 0906 Hrs 15.4	65576 @ 1113 Hrs 65505 @ 1118 Hrs 14.2	982999 @ 1321 Hrs. 982768 ? @ 1321 Hrs 6.2	
33. Feed Type	III	III	III	
34. Observations			Kiln in the hole	

O.O.S. - out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 10/25/83

Engineer RCB

1. Test Number	10/25-1	10/25-2		
2. Time	0855	1120		
3. Baghouse Inlet Temp., °F	—	—		
4. Baghouse ΔP, "H_2O	—	—		
5. Multiclone Inlet Temp., °F	—	-		
6. Kiln ID Fan Damper Position (% open)	58	58		
7. Oxygen, %	4.0±.5	2.5±1.0		
8. Combustibles/CO_2, %	0/28.8	0/29.6		
9. Kiln Chain Temp., °F	1380	1360		
10. Kiln End Housing Pressure, in H_2O	-.58	-.55		
11. Kiln Speed, revs/hr (rph)	66	60		
12. Kiln Feeder Speed, revs/min (rpm)	13	12		
13. CO, ppm	0	0		
14. NO_x, ppm	450	1200		
15. Kiln Shell Temp, °F (highest reading)	580	480		
16. Kiln Feed Bin Level (feet down from bin top)	—	—		

10/25/83

	1	2		
17. Kiln Load, amps	180-200	200		
18. Kiln Hood Pressure, in H_2O	-.16	-.20		
19. Cooler Air Temp., °F	1250	1350		
20. Cooler Speed, revs/min (rpm)	12	13.5		
21. Cooler Undergrate Temperature, °F	0.0.S	0.0.S		
22. Cooler Undergrate Pressure, in H_2O	4.0	5.3		
23. Material Temperature, °F	1900-2400	2480		
24. Coal Mill Motor Amps	30	30		
25. Coal Mill Inlet Pressure, in H_2O	-1.9	-2.2		
26. Coal Mill Outlet Pressure, in H_2O	+18.3	+18.3		
27. Coal Mill Feed Rate, **(% scale x 15 tons/hr)**	10	10		
28. Cyclone Tempering Air, °F	730	700		
29. Coal Mill Inlet Temperature, °F	560	530		
30. Coal Feed Rate Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .01 x 12 = tons/hr**	85530 @ 0907 HRS. 85459 @ 0902 HRS 9.2	87710 @ 1130 HRS 87634 @ 1125 HRS 9.1		
31. Clinker Belt Scale Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .1 x 12 = tons/hr**	0.0.S.	0.0.S		
32. Kiln Feeder Revs Integrator **t = 0 minutes** **t = 5 minutes** **(Δ/5 = rpm)**	997073 @ 0907 HRS 997014 @ 0902 HRS 11.8	998660 @ 1130 HRS 998604 @ 1125 HRS 11.2		
33. Feed Type	III	III		
34. Observations				

0.0.S. - Out of Sreuice

INSTRUMENT CALIBRATION RECORD

DATE 9-26-83

TEST SITE 4

INSTRUMENT TIME	NO	O2	CO	CO2	SO2	
11:15	✓	✓	-	✓	-	
12:45	✓	✓	-	✓	-	
15:10	✓	✓	-	✓	-	
16:10	✓	✓	-	✓	-	

INSTRUMENT CALIBRATION RECORD

DATE 9-27-83

TEST SITE 4

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
9:00	✓	✓	-	✓	-	
10:30	✓	✓	-	✓	-	
12:00	✓	✓	-	✓	-	
12:45	✓	✓	-	✓	-	
14:30	✓	✓	-	✓	-	

INSTRUMENT CALIBRATION RECORD

DATE 9-28-83

TEST SITE 4

INSTRUMENT	NO	O_2	CO	CO_2	SO_2	
TIME						
8:40	✓	✓	-	✓	-	
9:50	✓	✓	-	✓	-	
11:00	✓	✓	-	✓	-	
12:40	✓	✓	-	✓	-	
13:55	✓	✓	-	✓	-	
15:10	✓	✓	-	✓	-	

INSTRUMENT CALIBRATION RECORD

DATE 9-29-83

TEST SITE 4

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
8:30	✓	✓	-	✓	-	
9:10	✓	✓	-	✓	-	
10:35	✓	✓	-	-	-	
11:37	✓	✓	-	✓	-	
12:32	✓	✓	-	✓	-	
13:37	✓	✓	-	✓	-	
14:20	✓	✓	-	✓	-	
15:20	✓	✓	-	✓	-	

INSTRUMENT CALIBRATION RECORD

DATE 9-29-83

TEST SITE 4

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
8:30	✓	✓	-	✓	-	
9:10	✓	✓	-	✓	-	
10:35	✓	✓	-	-	-	
11:37	✓	✓	-	✓	-	
12:32	✓	✓	-	✓	-	
13:37	✓	✓	-	✓	-	
14:20	✓	✓	-	✓	-	
15:20	✓	✓	-	✓	-	

INSTRUMENT CALIBRATION RECORD

DATE 9-30-83

TEST SITE 4

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
8:40	✓	✓	-	✓	-	
10:10	✓	✓	-	✓	-	
11:10	✓	✓	-	✓	-	
12:10	✓	✓	-	✓	-	
13:20	✓	✓	-	✓	-	
14:50	✓	✓	-	✓	-	

INSTRUMENT CALIBRATION RECORD

DATE 10-3-83

TEST SITE 4

INSTRUMENT	NO	O_2	CO	CO_2	SO_2	
TIME						
8:30	✓	✓	-	✓	-	
10:00	✓	✓	-	✓	-	
11:30	✓	✓	-	✓	-	
12:30	✓	✓	-	✓	-	

INSTRUMENT CALIBRATION RECORD

DATE 10-4-83 TEST SITE 4

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
8:10	✓	✓	✓	✓	–	
9:20	✓	✓	✓	✓	–	
10:22	✓	✓	✓	✓	–	
11:25	✓	✓	✓	✓	–	
12:31	✓	✓	✓	✓	–	
13:16	✓	✓	✓	✓	–	

INSTRUMENT CALIBRATION RECORD

DATE 10-5-83

TEST SITE 4

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
800	✓	✓	✓	✓	–	
9:00	✓	✓	✓	✓	–	
10:00	✓	✓	✓	✓	–	
10:46	✓	✓	✓	✓	–	
12:05	✓	✓	✓	✓	–	
13:05	✓	✓	✓	✓	–	
14:05	✓	✓	✓	✓	–	
15:05	✓	✓	✓	✓	–	

INSTRUMENT CALIBRATION RECORD

DATE 10-6-83

TEST SITE 4

INSTRUMENT	NO	O_2	CO	CO_2	SO_2	
TIME						
7:30	✓	✓	✓	✓	—	
9:20	✓	✓	✓	✓	—	
10:20	✓	✓	✓	✓	—	

INSTRUMENT CALIBRATION RECORD

DATE 10-7-83

TEST SITE ________

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
7:15	✓	✓	✓	✓	–	
8:20	✓	✓	✓	✓	–	
11:20	✓	✓	✓	✓	–	
14:05	✓	✓	✓	✓	–	

INSTRUMENT CALIBRATION RECORD

DATE 10-10-83

TEST SITE 4

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
8:24	✓	✓	✓	✓	–	
9:16	✓	✓	✓	✓	–	
10:05	✓	✓	✓	✓	–	
11:01	✓	✓	✓	✓	–	
12:05	✓	✓	✓	✓	–	
13:25	✓	✓	✓	✓	–	
14:17	✓	✓	✓	✓	–	
15:01	✓	✓	✓	✓	–	

INSTRUMENT CALIBRATION RECORD

DATE 10-11-83

TEST SITE 4

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
8:35	✓	✓	✓	✓	–	
9:35	✓	✓	✓	✓	–	
11:05	✓	✓	✓	✓	–	
12:16	✓	✓	✓	✓	–	
13:05	✓	✓	✓	✓	–	
14:05	✓	✓	✓	✓	–	
15:05	✓	✓	✓	✓	–	

INSTRUMENT CALIBRATION RECORD

DATE 10-12-83

TEST SITE 4

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
8:30	✓	✓	✓	✓	-	
9:06	✓	✓	✓	✓	-	
10:05	✓	✓	✓	✓	-	
13:05	✓	✓	✓	✓	-	

INSTRUMENT CALIBRATION RECORD

DATE 10-13-83

TEST SITE 4

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
8:30	✓	✓	✓	✓	-	
9:30	✓	✓	✓	✓	-	
10:35	✓	✓	✓	✓	-	
11:28	✓	✓	✓	✓	-	
12:48	✓	✓	✓	✓	-	
13:30	✓	✓	✓	✓	-	
14:35	✓	✓	✓	✓	-	

INSTRUMENT CALIBRATION RECORD

DATE 10-14-83

TEST SITE 4

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
8:35	✓	✓	✓	✓	-	
9:45	✓	✓	✓	✓	-	
10:45	✓	✓	✓	✓	-	
13:10	✓	✓	✓	✓	-	
14:00	✓	✓	✓	✓	-	

INSTRUMENT CALIBRATION RECORD

DATE 10-24-83

TEST SITE 4

INSTRUMENT	NO	O_2	CO	CO_2	SO_2	
TIME						
9:45	✓	✓	✓	✓	–	
11:00	✓	✓	✓	✓	–	
11:30	✓	✓	✓	✓	–	
12:15	✓	✓	✓	✓	–	
13:30	✓	✓	✓	✓	–	

INSTRUMENT CALIBRATION RECORD

DATE 10-25-83

TEST SITE ________

INSTRUMENT	NO	O_2	CO	CO_2	SO_2	
TIME						
10:00	✓	✓	✓	✓	–	
11:15	✓	✓	✓	✓	–	
12:30	✓	✓	✓	✓	–	
14:30	✓	✓	✓	✓	–	

INSTRUMENT CALIBRATION RECORD

DATE 10-25-83　　TEST SITE________

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
10:00	✓	✓	✓	✓	–	
11:15	✓	✓	✓	✓	–	
12:30	✓	✓	✓	✓	–	
14:30	✓	✓	✓	✓	–	

F-462

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

WESTERN DIVISION MANAGER
GAIL D. PALMER

SINCE 1908

PLEASE ADDRESS ALL CORRESPONDENCE TO
1489 CANAL AVE., LONG BEACH, CA 90813
OFFICE TEL. (213) 437-6668

KVB
Skypark Blvd.
P.O. Box 19518
Irvine, Ca. 92714

October 28, 1983

Sample identification
by

Commercial Testing & Engineering

9/30/83 0900
Coal Sample # 2
K-1

Kind of sample reported to us	Coal
Sample taken at	xxxx
Sample taken by	KVB
Date sampled	9/30/83
Date received	10/18/83

Analysis report no. 77-1701

PROXIMATE ANALYSIS

	As Received	Dry Basis
% Moisture	2.08	xxxxx
% Ash	11.33	11.57
% Volatile	37.40	38.19
% Fixed Carbon	49.19	50.24
	100.00	100.00
Btu/lb.	12290	12551
% Sulfur	0.57	0.58

FUSION TEMPERATURE OF ASH

	Reducing		Oxidizing	
Initial Deformation	xxxx	°F	xxxx	°F
Softening (H = W)	xxxx	°F	xxxx	°F
Softening (H = ½W)	xxxx	°F	xxxx	°F
Fluid	xxxx	°F	xxxx	°F

H = Cone Height
W = Cone Width

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Dennis Shaw
Manager, Long Beach Laboratory

Charter Member

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OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS,
TIDEWATER AND GREAT LAKES PORTS AND RIVER LOADING

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KVB
18006 Skypark Blvd.
P.O. Box 19518
Irvine, Ca. 92714

October 28, 1983

Sample identification by

Commercial Testing & Engineering

10/3/83 1400
Sample # 3

Kind of sample reported to us	Coal
Sample taken at	xxxx
Sample taken by	KVB
Date sampled	10/3/83
Date received	10/18/83

Analysis report no. 77-1702

PROXIMATE ANALYSIS

	As Received	Dry Basis
% Moisture	2.10	xxxxx
% Ash	10.46	10.68
% Volatile	37.70	38.51
% Fixed Carbon	49.74	50.81
	100.00	100.00
Btu/lb.	12397	12663
% Sulfur	0.56	0.57

FUSION TEMPERATURE OF ASH

	Reducing		Oxidizing	
Initial Deformation	xxxx	°F	xxxx	°F
Softening (H = W)	xxxx	°F	xxxx	°F
Softening (H = ½W)	xxxx	°F	xxxx	°F
Fluid	xxxx	°F	xxxx	°F

H = Cone Height
W = Cone Width

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Dennis Shaw
Manager, Long Beach Laboratory

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WESTERN DIVISION MANAGER
GAIL D. PALMER

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18006 Skypark Blvd.
P.O. Box 19518
Irvine, Ca. 92714

October 28, 1983

Sample identification by

Commercial Testing & Engineering

10/5/83 0915
Sample # 5

Kind of sample reported to us	Coal
Sample taken at	xxxx
Sample taken by	KVB
Date sampled	10/5/83
Date received	10/18/83

Analysis report no. 77-1703

PROXIMATE ANALYSIS

	As Rec'd	Dry Basis
% Moisture	2.26	xxxxx
% Ash	11.43	11.69
% Volatile	37.29	38.15
% Fixed Carbon	49.02	50.16
	100.00	100.00
Btu/lb.	12260	12543
% Sulfur	0.54	0.55

ULTIMATE ANALYSIS

	As Rec'd	Dry Basis
% Moisture	2.26	xxxxx
% Carbon	69.11	70.71
% Hydrogen	4.65	4.76
% Nitrogen	1.43	1.46
% Chlorine	0.02	0.02
% Sulfur	0.54	0.55
% Ash	11.43	11.69
% Oxygen(diff)	10.56	10.81
	100.00	100.00

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Dennis Shaw
Manager, Long Beach Laboratory

Charter Member

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KVB
18006 Skypark Blvd.
P.O. Box 19518
Irvine, Ca. 92714

October 28, 1983

Sample identification
by

Commercial Testing & Engineering

10/10/83 1100
Sample # 6

Kind of sample reported to us	Coal
Sample taken at	xxxx
Sample taken by	KVB
Date sampled	10/10/83
Date received	10/18/83

Analysis report no. 77-1704

PROXIMATE ANALYSIS

	As Received	Dry Basis
% Moisture	2.37	xxxxx
% Ash	10.06	10.30
% Volatile	37.73	38.65
% Fixed Carbon	49.84	51.05
	100.00	100.00
Btu/lb.	12458	12760
% Sulfur	0.56	0.57

FUSION TEMPERATURE OF ASH

	Reducing		Oxidizing	
Initial Deformation	xxxx	°F	xxxx	°F
Softening (H = W)	xxxx	°F	xxxx	°F
Softening (H = ½W)	xxxx	°F	xxxx	°F
Fluid	xxxx	°F	xxxx	°F

H = Cone Height
W = Cone Width

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Long Beach Laboratory

Charter Member

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WESTERN DIVISION MANAGER
GAIL D. PALMER

PLEASE ADDRESS ALL CORRESPONDENCE TO
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OFFICE TEL. (213) 437-6668

KVB
18006 Skpark Blvd.
P.O. Box 19518
Irvine, Ca. 92714

October 28, 1983

Sample identification
by

Commercial Testing & Engineering

10/11/83 1430
Sample # 8

Kind of sample reported to us	Coal
Sample taken at	xxxx
Sample taken by	KVB
Date sampled	10/11/83
Date received	10/18/83

Analysis report no. 77-1706

PROXIMATE ANALYSIS

	As Received	Dry Basis
% Moisture	2.60	xxxxx
% Ash	12.00	12.32
% Volatile	37.02	38.01
% Fixed Carbon	48.38	49.67
	100.00	100.00
Btu/lb.	12039	12360
% Sulfur	0.61	0.63

FUSION TEMPERATURE OF ASH

	Reducing		Oxidizing	
Initial Deformation	xxxx	°F	xxxx	°F
Softening (H=W)	xxxx	°F	xxxx	°F
Softening (H=½W)	xxxx	°F	xxxx	°F
Fluid	xxxx	°F	xxxx	°F

H = Cone Height
W = Cone Width

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Dennis Shaw
Manager, Long Beach Laboratory

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WESTERN DIVISION MANAGER
GAIL D. PALMER

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OFFICE TEL. (213) 437-6668

KVB
18006 Skypark Blvd.
P.O. Box 19518
Irvine, Ca. 92714

October 28, 1983

Sample identification by

Commercial Testing & Engineering

10/14/83 1350
Sample # 12

Kind of sample reported to us	Coal
Sample taken at	xxxx
Sample taken by	KVB
Date sampled	10/14/83
Date received	10/18/83

Analysis report no. 77-1705

PROXIMATE ANALYSIS

	As Rec'd	Dry Basis
% Moisture	3.19	xxxxx
% Ash	11.42	11.80
% Volatile	36.65	37.86
% Fixed Carbon	48.74	50.34
	100.00	100.00
Btu/lb.	12111	12510
% Sulfur	0.55	0.57

ULTIMATE ANALYSIS

	As Rec'd	Dry Basis
% Moisture	3.19	xxxxx
% Carbon	69.53	71.82
% Hydrogen	4.64	4.79
% Nitrogen	1.38	1.43
% Chlorine	0.02	0.02
% Sulfur	0.55	0.57
% Ash	11.42	11.80
% Oxygen(diff)	9.27	9.57
	100.00	100.00

FINENESS TEST

Screen Size(mesh)	% Retained
+50	0.00
50 x 100	0.27
100 x 200	7.77
200 x 0	91.92
	100.00

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Dennis Shaw

Manager, Long Beach Laboratory

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OVER 40 BRANCH LABORATORIES STRATEGICALLY LOCATED IN PRINCIPAL COAL MINING AREAS, TIDEWATER AND GREAT LAKES PORTS AND RIVER LOADING FACILITIES

ChemData Analytical Laboratory
3645 Inglewood Avenue, Suite 5 • Redondo Beach, California 90278
(213) 643-9900

TO:

KVB Engineering
18006 Skypark Blvd.
Irvine, Calif. 92714

DATE: December 19, 1983
CUSTOMER ORDER: 82514
CD REFERENCE: 83-1282

Analytical Data

The sample containers submitted by you have been analyzed for Nitrous Oxide and Oxygen content via gas chromatography. Following are the results:

Container No.	Oxygen	Nitrous Oxide
1	2.95%	6.9
2	-	4.5
3	-	5.6

All values are ppm by volume unless otherwise indicated.

If we may be of further service, please contact us.

Respectfully submitted,
James Stone
James Stone
Chemist

Notebook III, p143.

These results apply only to the samples investigated, and no others.
Our extent of liability is limited to the cost of analytical work performed.

DATA SET 2

NOVEMBER 15 AND 17, 1983

CONTROL ROOM DATA SHEET

KILN #1

DATE 11/15/83

Engineer RCB

1. Test Number	11/15-1	11/15-2	11/15-3	11/15-4
2. Time	0812	0830	0900	0930
3. Baghouse Inlet Temp., °F	—	—	—	—
4. Baghouse ΔP, "H_2O	—	—	—	—
5. Multiclone Inlet Temp., °F	—	—	—	—
6. Kiln ID Fan Damper Position (% open)	63	63	63	63
7. Oxygen, %	2.0 ± 1.0	2.5 ± 1.0	2.2 ± 1.0	2.1 ± .5
8. Combustibles/CO_2, %	0/30.0	0/28.5	0/30.0	0/30.0
9. Kiln Chain Temp., °F	—	1290	1290	1290
10. Kiln End Housing Pressure, in H_2O	-.61	-.65	-.65	-.65
11. Kiln Speed, revs/hr (rph)	73.0	73.5	73.5	73.5
12. Kiln Feeder Speed, revs/min (rpm)	15.2	15.5	15.3	15.3
13. CO, ppm	0	0	0	0
14. NO_x, ppm	1250 ± 50	1250 ± 50	1500 ± 50	1200 ± 30
15. Kiln Shell Temp, °F (highest reading)	640	620	650	650
16. Kiln Feed Bin Level (feet down from bin top)	9.5	9.0	6.5	7.8

11/15/83

	1	2	3	4
17. Kiln Load, amps	240	235	235	235
18. Kiln Hood Pressure, in H_2O	-.15	-.12	-.13	-.15
19. Cooler Air Temp., °F	O.O.S.	O.O.S.	O.O.S	O.O.S
20. Cooler Speed, revs/min (rpm)	16.5	16.5	16.5	16.5
21. Cooler Undergrate Temperature, °F	O.O.S.	O.O.S	O.O.S.	O.O.S.
22. Cooler Undergrate Pressure, in H_2O	4.3	4.2	4.2	4.7
23. Material Temperature, °F	2500	2480	2520	2440
24. Coal Mill Motor Amps	–	45	44.5	44.5
25. Coal Mill Inlet Pressure, in H_2O	–	-2.8	-2.8	-2.8
26. Coal Mill Outlet Pressure, in H_2O	–	+14.5	+14.5	+16.7
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	–	67	67	67
28. Cyclone Tempering Air, °F	–	700	700	700
29. Coal Mill Inlet Temperature, °F	–	530	530	530
30. Coal Feed Rate Integrator				
t = 0 minutes	556428	–	556790	557275
t = 5 minutes	656506	–	556867	557196
Δ x .01 x 12 = tons/hr	9.4	–	9.2	9.5
31. Clinker Belt Scale Integrator				
t = 0 minutes	782535	–	782904	783387
t = 5 minutes	782620	–	782980	783310
Δ x .1 x 12 = tons/hr	10 2*	–	9 1*	9 2*
32. Kiln Feeder Revs Integrator				
t = 0 minutes	400330	–	400642	401034
t = 5 minutes	400402	–	400794	401107
(Δ/5 = rpm)	14.4	–	14.4	14.6
33. Feed Type	II	II	II	II
34. Observations				

O.O.S. - Out of Service

*Clinker from both kilns

CONTROL ROOM DATA SHEET

KILN #1

DATE 11/15/83

Engineer RCB

1. Test Number	11/15-5	11/15-6	11/15-7	11/15-8
2. Time	0945	1015	1030	1045
3. Baghouse Inlet Temp., °F	–	–	–	–
4. Baghouse ΔP, "H_2O	–	–	–	–
5. Multiclone Inlet Temp., °F	–	–	–	–
6. Kiln ID Fan Damper Position (% open)	62	62	62	62
7. Oxygen, %	–	2.0 ± .8	2.1 ± 1.0	1.8 ± 1.0
8. Combustibles/CO_2, %	0/29.0	0/30.0	0/30.0	0/30.0
9. Kiln Chain Temp., °F	1290	1290	1290	1290
10. Kiln End Housing Pressure, in H_2O	–	-.65	-.61	-.64
11. Kiln Speed, revs/hr (rph)	73	73	73	70
12. Kiln Feeder Speed, revs/min (rpm)	15.3	15.3	15.4	14.3
13. CO, ppm	0	0	0	0
14. NO_x, ppm	1230 ± 30	900 ± 50	950 ± 50	750 ± 50
15. Kiln Shell Temp, °F (highest reading)	660	660	660	-
16. Kiln Feed Bin Level (feet down from bin top)	8	9.5	10	6

11/15/83

	5	6	7	8
17. Kiln Load, amps	250	250	240	220
18. Kiln Hood Pressure, in H_2O	-.12	-.18	-.18	-.18
19. Cooler Air Temp., °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
20. Cooler Speed, revs/min (rpm)	16.5	16.5	16.5	16.5
21. Cooler Undergrate Temperature, °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
22. Cooler Undergrate Pressure, in H_2O	4.5	5.3	4.9	4.8
23. Material Temperature, °F	2470	2390	2380	2350
24. Coal Mill Motor Amps	45	44	44.5	44
25. Coal Mill Inlet Pressure, in H_2O	-2.8	-2.8	-2.8	-2.9
26. Coal Mill Outlet Pressure, in H_2O	+14.5	+14.5	+14.5	+14.5
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11.1	11.1	11.1	11.1
28. Cyclone Tempering Air, °F	700	700	700	700
29. Coal Mill Inlet Temperature, °F	530	530	530	540
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	557461 557539 9.4	557943 558024 9.7	558228 558308 9.6	558395 558473 9.4
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	783578 783660 98*	784071 784154 99*	784377 784461 100*	784549 784630 97*
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	401276 401348 14.4	401718 401792 14.8	401979 402051 14.4	402127 402195 13.6
33. Feed Type	II	II	II	II
34. Observations				

O.O.S. - out of Service

* Clinker output for both Kilns

CONTROL ROOM DATA SHEET

KILN #1

DATE 11/15/83

Engineer RCB

1. Test Number	11/15-9	11/15-10	11/15-11	11/15-12
2. Time	1100	1130	1200	1230
3. Baghouse Inlet Temp., °F	–	–	–	–
4. Baghouse ΔP, "H_2O	–	–	–	–
5. Multiclone Inlet Temp., °F	–	–	–	–
6. Kiln ID Fan Damper Position (% open)	63	63	63	63
7. Oxygen, %	2.0 ± 1.0	2.0 ± .5	1.7 ± .5	1.6 ± .5
8. Combustibles/CO_2, %	0/30.0	0/30.0	0/30.5	0/31.0
9. Kiln Chain Temp., °F	1290	1290	1290	1290
10. Kiln End Housing Pressure, in H_2O	-.61	- 6.5	-.60	-.59
11. Kiln Speed, revs/hr (rph)	70-71	73	74.5	74.5
12. Kiln Feeder Speed, revs/min (rpm)	14.4-15	15.5	15.7	15.7
13. CO, ppm	0	0	0	0
14. NO_x, ppm	1000	1400	1600	1600 ± 100
15. Kiln Shell Temp, °F (highest reading)	670	650	640	650
16. Kiln Feed Bin Level (feet down from bin top)	6	5	6	8

11/15/83

	9	10	11	12
17. Kiln Load, amps	230	240	250	245
18. Kiln Hood Pressure, in H_2O	-.13	-.14	-.11	-.11
19. Cooler Air Temp., °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
20. Cooler Speed, revs/min (rpm)	14.0	16.5	16.5	16.4
21. Cooler Undergrate Temperature, °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
22. Cooler Undergrate Pressure, in H_2O	4.5	4.3	4.1	4.2
23. Material Temperature, °F	2440	2540	2560	2550
24. Coal Mill Motor Amps	44.0	44.0	43.5	43.5
25. Coal Mill Inlet Pressure, in H_2O	-3.0	-2.8	-2.8	-2.8
26. Coal Mill Outlet Pressure, in H_2O	+14.5	+14.5	+14.5	+14.5
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11.1	11.1	11.1	11.1
28. Cyclone Tempering Air, °F	700	700	700	708
29. Coal Mill Inlet Temperature, °F	530	530	540	540
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	 558708 558789 9.7	 559213 559293 9.6	 559594 559672 9.4	 560067 560148 9.7
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	 784945 784867 93.6*	 785200 785239 46.8	 785393 — —	 85635 785678 51.6
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	 402475 402402 14.6	 402861 402934 14.6	 403213 403287 14.8	 403655 403732 15.4
33. Feed Type	II	II	II	II
34. Observations				

O.O.S. - Out of Service

* clinker output for both Kilns

CONTROL ROOM DATA SHEET

KILN #1

DATE 11/15/83

Engineer RCB

1. Test Number	11/15-13	11/15-14	11/15-15	11/15-16
2. Time	1245	1300	1315	1330
3. Baghouse Inlet Temp., °F	—	—	—	—
4. Baghouse ΔP, "H_2O	—	—	—	—
5. Multiclone Inlet Temp., °F	—	—	—	—
6. Kiln ID Fan Damper Position (% open)	63	63	63	63
7. Oxygen, %	2.0±.5	1.7±.5	1.7±.5	1.6±.5
8. Combustibles/CO_2, %	0/30.0	0/31.0	0/30.0	0/29.5
9. Kiln Chain Temp., °F	1290	1290	1290	1290
10. Kiln End Housing Pressure, in H_2O	-.60	-.59	-.60	-.65
11. Kiln Speed, revs/hr (rph)	73.5	73.5	73.5	74.5
12. Kiln Feeder Speed, revs/min (rpm)	15.4	15.4	15.4	15.6
13. CO, ppm	0	0	0	0
14. NO_x, ppm	1500±200	1550±100	1500±100	1250±50
15. Kiln Shell Temp, °F (highest reading)	640	650	650	670
16. Kiln Feed Bin Level (feet down from bin top)	9	8	5	7

11/15/83

	13	14	15	16
17. Kiln Load, amps	255	260	255	255
18. Kiln Hood Pressure, in H_2O	-.10	-.11	-.12	-.13
19. Cooler Air Temp., °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
20. Cooler Speed, revs/min (rpm)	16.5	16.5	16.5	16.5
21. Cooler Undergrate Temperature, °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
22. Cooler Undergrate Pressure, in H_2O	4.4	4.3	4.1	4.5
23. Material Temperature, °F	2520	2550	2540	2500
24. Coal Mill Motor Amps	43.5	43.5	43.5	43.5
25. Coal Mill Inlet Pressure, in H_2O	-2.5	-2.2	-2.2	-2.5
26. Coal Mill Outlet Pressure, in H_2O	+14.5	+14.5	+14.5	+14.5
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11.1	11.1	11.1	11.1
28. Cyclone Tempering Air, °F	700	700	700	700
29. Coal Mill Inlet Temperature, °F	530	530	530	530
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	 560377 560411 9.5	 - - -	 - - -	 - - -
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	 785784 785831 56.4	 - - -	 - - -	 - - -
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	 403900 403975 15.0	 - - -	 - - -	 - - -
33. Feed Type	II	II	II	II
34. Observations				

O.O.S. - out of Srevice

CONTROL ROOM DATA SHEET

KILN #1

DATE 11/15/83

Engineer RCB

1. Test Number	11/15-17	11/15-18	11/15-19	11/15-20
2. Time	1345	1400	1415	1430
3. Baghouse Inlet Temp., °F	—	—	—	—
4. Baghouse ΔP, "H_2O	—	—	—	—
5. Multiclone Inlet Temp., °F	—	—	—	—
6. Kiln ID Fan Damper Position (% open)	63	63	63	63
7. Oxygen, %	1.5 ± .7	1.6 ± .6	1.4 ± .8	1.2 ± .5
8. Combustibles/CO_2, %	0/29.0	0/30.0	0/30.0	0/90.0
9. Kiln Chain Temp., °F	1290	1290	1290	1290
10. Kiln End Housing Pressure, in H_2O	-.57	-.58	-.59	-.57
11. Kiln Speed, revs/hr (rph)	74.5	77	80	85
12. Kiln Feeder Speed, revs/min (rpm)	15.7	16.1	16.5	17.5
13. CO, ppm	0	0	0	0
14. NO_x, ppm	1250 ± 200	(spikes) 1300 - 2000	1300-1700	1200-1500
15. Kiln Shell Temp, °F (highest reading)	680	—	690	-
16. Kiln Feed Bin Level (feet down from bin top)	8	7	8	8

11/15/83

	17	18	19	20
17. Kiln Load, amps	250	260	280	270
18. Kiln Hood Pressure, in H_2O	-.11	-.12	-.10	-.10
19. Cooler Air Temp., °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
20. Cooler Speed, revs/min (rpm)	16.5	16.5	16.5	16.5
21. Cooler Undergrate Temperature, °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
22. Cooler Undergrate Pressure, in H_2O	4.4	4.4	4.3	4.3
23. Material Temperature, °F	2520	2520	2550	2520
24. Coal Mill Motor Amps	43.5	43.0	43.5	43.0
25. Coal Mill Inlet Pressure, in H_2O	-2.6	-2.1	-2.0	-2.0
26. Coal Mill Outlet Pressure, in H_2O	+14.5	+14.5	+14.5	+14.5
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11.1	11.1	11.1	11.1
28. Cyclone Tempering Air, °F	700	700	700	700
29. Coal Mill Inlet Temperature, °F	540	540	530	530
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	 – – –	 561492 561572 7.9	 – – –	 561952 562031 5.3
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	 – – –	 786476 786542 96*	 – – –	 786800 786844 95*
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	 – – –	 404986 405063 15.4	 – – –	 405460 405546 17.2
33. Feed Type	II	II	II	II
34. Observations				

O.O.S. - Out of Service

*clinker output for both kilns

CONTROL ROOM DATA SHEET

KILN #1

DATE 11/15/83

Engineer RCB

1. Test Number	11/15-21	11/15-22	11/15-23	11/15-24
2. Time	1500	1515	1530	1545
3. Baghouse Inlet Temp., °F	—	—	—	—
4. Baghouse ΔP, "H_2O	—	—	—	—
5. Multiclone Inlet Temp., °F	—	—	—	—
6. Kiln ID Fan Damper Position (% open)	63	63	63	63
7. Oxygen, %	1.5±1.0	1.6±.7	1.8±1.0	1.8±.9
8. Combustibles/CO_2, %	0/31.5	0/31.5	0/29.5	0/29.5
9. Kiln Chain Temp., °F	1280	1270	1270	1260
10. Kiln End Housing Pressure, in H_2O	-.60	-.60	-.64	-.60
11. Kiln Speed, revs/hr (rph)	80	80.7	80.7	80.7
12. Kiln Feeder Speed, revs/min (rpm)	16.5	17.0	17.0	17.0
13. CO, ppm	0	0	0	0
14. NO_x, ppm	1050-1500	1050-2000	900-1100	1250±100
15. Kiln Shell Temp, °F (highest reading)	670	670	-	680
16. Kiln Feed Bin Level (feet down from bin top)	8	5	6	9

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	21	22	23	24
17. Kiln Load, amps	265	270	250	270
18. Kiln Hood Pressure, in H_2O	-.14	-.19	-.21	-.15
19. Cooler Air Temp., °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
20. Cooler Speed, revs/min (rpm)	16.5	16.5	16.5	16.5
21. Cooler Undergrate Temperature, °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
22. Cooler Undergrate Pressure, in H_2O	4.3	4.5	4.7	4.3
23. Material Temperature, °F	2450	2430	2430	2500
24. Coal Mill Motor Amps	43	42.5	42.5	42.5
25. Coal Mill Inlet Pressure, in H_2O	-2.9	-2.3	-2.3	-2.3
26. Coal Mill Outlet Pressure, in H_2O	+14.5	+14.5	+14.5	+14.5
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11.1	11.1	11.1	11.1
28. Cyclone Tempering Air, °F	700	700	700	700
29. Coal Mill Inlet Temperature, °F	550	540	540	550
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	 562505 562426 9.5	 — — —	 — — —	 563100 563180 9.6
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	 787082 787128 55.2	 — — —	 — — —	 787484 787530 55.2
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	 405940 406021 15.8	 — — —	 — — —	 406633 406715 16.4
33. Feed Type	II	II	II	II
34. Observations				

O.D.S. - out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 11/17/83

Engineer RCB

1. Test Number	11/17-1	11/17-2	11/17-3	11/17-4
2. Time	0700	0740	0811	0845
3. Baghouse Inlet Temp., °F	—	—	—	—
4. Baghouse ΔP, "H_2O	—	—	—	—
5. Multiclone Inlet Temp., °F	—	—	—	—
6. Kiln ID Fan Damper Position (% open)	62	63	63	63
7. Oxygen, %	1.5	2.4	1.2	1.1
8. Combustibles/CO_2, %	0/31.2	0/31.2	0/31.0	0/31.0
9. Kiln Chain Temp., °F	1300	1300	1300	1300
10. Kiln End Housing Pressure, in H_2O	-.55/.65	-.55/.65	-.55/.65	-.55/.65
11. Kiln Speed, revs/hr (rph)	75	74	78	78
12. Kiln Feeder Speed, revs/min (rpm)	15.8	15.7	15.5	16.1
13. CO, ppm	0	0	0	0
14. NO_x, ppm	1500-1900	1000-1500	750-950	750-1000
15. Kiln Shell Temp, °F (highest reading)	640	620	300	660
16. Kiln Feed Bin Level (feet down from bin top)	9-12	10-12	9-13	6-12

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	1	2	3	4
17. Kiln Load, amps	260	240	250	260
18. Kiln Hood Pressure, in H_2O	-.07-.09	-.06-.10	-.10	-.08-.10
19. Cooler Air Temp., °F	—	—	—	—
20. Cooler Speed, revs/min (rpm)	16	16	16	16.2
21. Cooler Undergrate Temperature, °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
22. Cooler Undergrate Pressure, in H_2O	3.7	4.4	4.4	3.8
23. Material Temperature, °F	2550	2470	2430	2480
24. Coal Mill Motor Amps	47	48	48	48
25. Coal Mill Inlet Pressure, in H_2O	-1.7	-1.7	-1.2	-1.1
26. Coal Mill Outlet Pressure, in H_2O	+19.0	+18.5	+18.5	—
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11	11	11	11
28. Cyclone Tempering Air, °F	720	720	720	720
29. Coal Mill Inlet Temperature, °F	520	520	500/520	530
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	599800 599882 9.8	600376 600460 10.1	600861 600929 8.2	601365 601430 7.8
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	806115 — —	806489 — —	806674 806718 53	806938 806969 37
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	441646 441575 14.2	442163 442084 15.8	442535 442605 14.2	443017 443015 12.4
33. Feed Type	II	II	II	II
34. Observations				

O.O.S.- out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 11/17/83

Engineer ECB

	5	6	7	8
1. Test Number	11/17-5	11/17-6	11/17-7	11/17-8
2. Time	0920	0950	1040	1120
3. Baghouse Inlet Temp., °F	–	–	–	–
4. Baghouse ΔP, "H_2O	–	–	–	–
5. Multiclone Inlet Temp., °F	–	–	–	–
6. Kiln ID Fan Damper Position (% open)	63	63	62	63
7. Oxygen, %	.7	1.3	.4	.2
8. Combustibles/CO_2, %	0/31.6	0/31.6	0/31.6	0/31.6
9. Kiln Chain Temp., °F	1300	1280	1290	1300
10. Kiln End Housing Pressure, in H_2O	-.55	-.6	-.6	-.6
11. Kiln Speed, revs/hr (rph)	78	78	78	80
12. Kiln Feeder Speed, revs/min (rpm)	16.2	16.2	16.2	16.6
13. CO, ppm	0	0	0	0
14. NO_x, ppm	800-1550	550-700	450-800	150-400
15. Kiln Shell Temp, °F (highest reading)	640	400	300	580
16. Kiln Feed Bin Level (feet down from bin top)	6-11	5-12	8-13	8-11

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	5	6	7	8
17. Kiln Load, amps	265	260	255	260
18. Kiln Hood Pressure, in H_2O	-.04-.06	-.15	-.14	-.16
19. Cooler Air Temp., °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
20. Cooler Speed, revs/min (rpm)	16.1	16.1	16.1	16.1
21. Cooler Undergrate Temperature, °F	O.O.S.	O.O.S.	O.O.S.	O.O.S.
22. Cooler Undergrate Pressure, in H_2O	3.8	4.4	4.0	4.3
23. Material Temperature, °F	2490	2390	2400	2340
24. Coal Mill Motor Amps	48	47	48	48
25. Coal Mill Inlet Pressure, in H_2O	-1.0	-1.0	-.9	-.9
26. Coal Mill Outlet Pressure, in H_2O	+18.5	+18.5	+18.5	+18.5
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11	11	11	11
28. Cyclone Tempering Air, °F	720	720	720	720
29. Coal Mill Inlet Temperature, °F	550	540	520	480
30. Coal Feed Rate Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .01 x 12 = tons/hr**	602012 601932 9.6	602418 602343 9.0	603203 603132 8.5	603892 603818 8.9
31. Clinker Belt Scale Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .1 x 12 = tons/hr**	807309 807240 83	807550 807509 49	808600 807961 73	808377 808340 44
32. Kiln Feeder Revs Integrator **t = 0 minutes** **t = 5 minutes** **(Δ/5 = rpm)**	443650 443570 16.0	444049 443975 14.8	444824 444749 15.0	445510 445437 14.6
33. Feed Type	II	II	II	II
34. Observations				

O.O.S. - out of Service

CONTROL ROOM DATA SHEET

KILN #1

DATE 11/17/83

Engineer BY

1. Test Number	11/17-9			
2. Time	1335			
3. Baghouse Inlet Temp., °F	—			
4. Baghouse ΔP, "H_2O	—			
5. Multiclone Inlet Temp., °F	—			
6. Kiln ID Fan Damper Position (% open)	63			
7. Oxygen, %	1.3-2.0			
8. Combustibles/CO_2, %	0/30.4			
9. Kiln Chain Temp., °F	1300			
10. Kiln End Housing Pressure, in H_2O	-.6			
11. Kiln Speed, revs/hr (rph)	73			
12. Kiln Feeder Speed, revs/min (rpm)	15.2			
13. CO, ppm	0			
14. NO_x, ppm	600-1100			
15. Kiln Shell Temp, °F (highest reading)	640			
16. Kiln Feed Bin Level (feet down from bin top)	10-15			

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	9			
17. Kiln Load, amps	240			
18. Kiln Hood Pressure, in H_2O	-.2			
19. Cooler Air Temp., °F	O.O.S.			
20. Cooler Speed, revs/min (rpm)	16.1			
21. Cooler Undergrate Temperature, °F	O.O.S			
22. Cooler Undergrate Pressure, in H_2O	4.2			
23. Material Temperature, °F	2360			
24. Coal Mill Motor Amps	48			
25. Coal Mill Inlet Pressure, in H_2O	-1.7			
26. Coal Mill Outlet Pressure, in H_2O	—			
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	11			
28. Cyclone Tempering Air, °F	780			
29. Coal Mill Inlet Temperature, °F	510			
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	 605 936 605 862 8.9			
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	 809503 809474 35			
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	 447509 447463 9.2			
33. Feed Type	II			
34. Observations				

O.O.S. – out of Service

SITE 4
NITROGEN INJECTION DATA SHEETS

Sample Location Burner Pipe
Date 11/15/83
Test Crew J. Marker

Time	N_2 Flowrate (scfh)	N_2 Injection Temp at Mill (°F)	Mill Outlet O_2, % dry	Comments
1307	start		19.6	
1308		300	19.5	
1310			19.4	
1311			20.4	
1313		500	20.4	
1315			20.2	
1316			20.1	
1317		468	19.4	
1318			19.3	
1319			19.1	
1323			19.2	
1325			19.3	
1329			19.6	
1331			19.7	
1334				Calibration
1336			19.8	
1338		536	19.8	
1342			19.7	
1344	100,000		19.9	Pump cavitating
1345			20.0	
1347			20.2	Repairing pumps
1348			18.9	Nitrogen off (problems)
1349	98,000		18.1 - 21.0	Back on
1351			17.4	
1352			17.4	
1353			17.3	
1356			17.4	
1358			17.2	
1359	98,000	570	17.1	

SITE 4
NITROGEN INJECTION DATA SHEETS

Sample Location Burner Pipe
Date 11/15/83
Test Crew J. Marker

Time	N_2 Flowrate (scfh)	N_2 Injection Temp at Mill (°F)	Mill Outlet O_2, % dry	Comments
1400			17.0	
1404			17.0	
1406			17.0	
1407	98,000	540	17.1	
1409			17.0	
1410			17.0	
1411			16.9	
1413				Calibration Inst. 21%
1415	98,000		17.0	
1418			17.0	
1420			17.1	
1422	98,000	548	16.9	
1425			16.9	
1427			16.9	
1430	98,000		16.9	
1435			17.0	
1437	98,000	532	17.0	
1440			17.0	
1441				Calibration Inst 21%
1446				Reducing Flow Rate - off
1447			17.8	
1448			20.5	

SITE 4
NITROGEN INJECTION DATA SHEETS

Sample Location Burner Pipe
Date 11/17/83
Test Crew J. MacKee

Time	N_2 Flowrate (scfh)	N_2 Injection Temp at Mill (°F)	Mill Outlet O_2, % dry	Comments
0744				CAL.bration Inst. 21%
0800			21.0	
0807			20.6	Started Injection
0808			20.5	
0809	143,000	491	15.6	
0813			15.6	
0815			15.6	
0817			15.5	
0820			15.5	
0822	106,000	541	15.5	
0824			15.5	
0826			15.4	
0828			15.5	
0830			15.5	
0832			15.5	
0834		538	15.5	
0836			15.5	
0837				Calibrated instruments, 21% O_2
0838	143,000		15.5	
0840			15.5	
0842			15.5	
0844			15.6	
0846	143,000	519	15.6	
0848			15.7	
0852			16.0	
0854			16.0	
0856			16.0	
0858			16.0	
0900		497	16.1	

SITE 4
NITROGEN INJECTION DATA SHEETS

Sample Location Buense Pipe
Date 11/17/83
Test Crew J. Maekee

Time	N_2 Flowrate (scfh)	N_2 Injection Temp at Mill (°F)	Mill Outlet O_2, % dry	Comments
0902			15.9	
0904			15.9	
0906			15.9	
0908	143,000		15.9	
0909		500	15.9	
0914				Cal.brated Inst.
0916			15.9	
0918			15.9	
0920			15.9	
0922			15.9	
0926			15.9	
0928			15.7	
0930			15.9	
0934	143,000		16.0	
0935				Cal.brated Inst. 21%
0936		513	16.0	
0938			16.0	
0945			16.0	
0948			15.9	
0952			15.9	
0954			15.8	
0958			15.7	
1000	143,000	513	15.6	
1002			15.7	
1004			15.7	
1008			15.7	
1012			15.5	
1017			15.4	
1023			15.4	

SITE 4
NITROGEN INJECTION DATA SHEETS

Sample Location Buense Pipe
Date 11/17/83
Test Crew J. Macker

Time	N_2 Flowrate (scfh)	N_2 Injection Temp at Mill (°F)	Mill Outlet O_2, % dry	Comments
1026			15.3	
1027				Cal bealtd Inst. 21%
1032		408	15.0	
1034			15.1	
1036			15.2	
1040	172,000	511	15.1	
1045			15.1	
1046			15.1	
1048			15.0	
1051				CAl. bealtd Inst. 21%
1052	200,000		15.1	
1054	196,000	516	14.8	
1056		465	14.4	
1058	196,000		14.4	
1100			14.4	
1102			14.3	
1106			14.2	
1107				CAl. bealtd Inst. 21%
1108			14.4	
1110		445	14.4	
1112			14.5	
1116			14.1	
1118	196,000		14.0	
1120			14.1	
1121				calibrated instrument 21%
1124			14.4	
1129				
1130			15.0	
1132			21.0	off

DATA SET 3

FEBRUARY 29 - MARCH 3, 1984

CONTROL ROOM DATA SHEET - CLINKER, FEEDER, COAL RATES

Day	Time	Clinker Weigh Belt Scale			Feeder Revs Counter			Coal Weigh Belt Scale		
		Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Coal Rate (tons/hr)
2/29	1131	757105	—	—	76047	—	—	535859	—	—
2/29	1200	757375	270	55.86	76500	453	55.13	536325	466	9.64
2/29	1300	757943	568	56.8	77431	931	54.76	537291	966	9.66
2/29	1400	758496	553	55.3	78313	882	51.88	538258	967	9.67
2/29	1500	759034	538	53.8	79260	947	55.71	539259	1001	10.01
2/29	1600	759592	558	55.8	80194	934	54.94	540233	974	9.74
2/29	1700	760169	577	57.7	81100	906	53.29	541184	951	9.51

1132 - switch to silo #4

1300 - big swings in NO associated with O_2 changes
slowed down kiln about 6 rph (80 → 74)

1520 - start to close down ID damper

FORMS/CRDS/3-84

1400 - add some kiln speed; mat. temp ↑ a little

CONTROL ROOM DATA SHEET - CLINKER, FEEDER, COAL RATES

Day	Time	Clinker Weigh Belt Scale			Feeder Revs Counter			Coal Weigh Belt Scale		
		Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Coal Rate (tons/hr)
3/1	1600	770477	-	-	97411	-	-	562505	-	-
3/1	1700	770978	501	50.1	98282	871	51.23	563484	979	9.79
3/1	1800	771439	461	46.1	99099	817	48.06	564438	954	9.54
3/1	1900	771936	497	49.7	99922	823	48.41	565399	961	9.61
3/1	2000	772423	487	48.7	100772	850	50.0	566378	1039	10.39
3/1	2100	772905	482	48.2	101562	790	46.47	567338	960	9.60
3/1	2200	773330	425	42.5	102377	815	47.94	568276	938	9.38
3/1	2300	773826	496	49.6	103160	783	46.06	569243	967	9.67
3/2	0000	774266	440	44.0	103964	804	47.29	570211	968	9.68
3/2	0100	774729	463	46.3	104738	774	45.53	571179	968	9.68
3/2	0200	775164	435	43.5	105536	798	46.94	572147	968	9.68
3/2	0300	775622	458	45.8	106320	784	46.12	573115	968	9.68
3/2	0400	776079	457	45.7	107076	756	44.47	574083	923	9.23
3/2	0500	776507	428	42.8	107857	781	45.94	575052	969	9.69
3/2	0600	776960	453	45.3	108637	780	45.88	576020	968	9.68

1700 - increased O_2
1858 - increased O_2 again
2000 - O_2 drifted down, raised O_2

0245 - lost some coating; mix change problem
0300 - front end cold; drop kiln speed
0500 - something holding mix back

0730 - bring feed forward
0747 - switch both kilns to belt #1

FORMS/CRDS/3-84

CONTROL ROOM DATA SHEET - CLINKER, FEEDER, COAL RATES

Day	Time	Clinker Weigh Belt Scale			Feeder Revs Counter			Coal Weigh Belt Scale		
		Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Coal Rate (tons/hr)
3/2	0730	777627	667	44.5	109810	1173	46.0	577489	1469	9.79
3/2	0747	777747	120	42.4	–	–	–	–	–	–
3/2	0800	–	–	–	–	–	–	–	–	–
3/2	0930	778561	–	–	111371	–	–	579423	–	–
3/2	1132	779426	865	42.6	113006	1635	47.4	581435	2012	9.91
3/2	1230	779830	404	41.8	113766	760	46.2	582351	916	9.48
3/2	1300	780056	226	45.2	114160	394	46.4	582827	476	9.52
3/2	1500	780920	864	43.2	115665	1505	44.3	584752	1925	9.63
3/2	1600	781337	417	41.7	116469	804	47.29	585715	963	9.63
3/2	1700	781792	455	45.5	117243	774	45.53	586683	968	9.68
3/2	1800	782186	394	39.4	118064	821	48.29	587644	961	9.61
3/2	2100	783583	1397	46.6	120480	2416	47.4	590579	2935	9.78
3/2	2200	784001	418	41.8	121203	723	42.53	591466	887	8.87
3/2	2300	784441	440	44.0	122033	830	48.82	592433	967	9.67
3/3	0000	784980	539	53.9	122828	795	46.76	593396	963	9.63

0800 K1 on B1 again
0930 Temp ~ 2400°F; O_2 still high
1132 Temp ~ 2300°F; O_2 1.5 % avg
1230 Temp. dropped to 2300°F, O_2 ~ 1.0%
} unstable feed conditions

1300 Temp. cycle to 2400°F; O_2 ~ 1.2%
1800 Problem w mix in hole; temp. 2150°F
2200 Ring in burning zone
3/3 0000 Kiln speed changes small

0300 speed change up, kiln load up; ring breakage running too hot a load

FORMS/CRDS/3-84

CONTROL ROOM DATA SHEET - CLINKER, FEEDER, COAL RATES

Day	Time	Clinker Weigh Belt Scale			Feeder Revs Counter			Coal Weigh Belt Scale		
		Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Coal Rate (tons/hr)
3/3	0100	785412	432	43.2	123648	820	48.23	594363	967	9.67
3/3	0200	785899	487	48.7	124460	812	47.76	595329	966	9.66
3/3	0300	786326	427	42.7	125287	827	48.65	596307	978	9.78
3/3	0400	786897	571	57.1	126081	794	46.71	597260	953	9.53
3/3	0500	787390	493	49.3	126883	802	47.18	598227	967	9.67
3/3	0600	787836	446	44.6	127684	801	47.12	599193	966	9.66
3/3	0700	788279	443	44.3	128506	822	48.35	600184	991	9.91
3/3	0800	788736	457	45.7	129329	823	48.41	601141	957	9.57
3/3	0900	789235	499	49.9	130131	802	47.18	602107	966	9.66
3/3	1000	789712	477	47.7	130921	790	46.47	603090	983	9.83
3/3	1100	790171	459	45.9	131646	725	42.65	604076	986	9.86
3/3	1200	790605	434	43.4	132397	751	44.18	605020	944	9.44
3/3	1300	791048	443	44.3	133210	813	47.82	605979	959	9.59
3/3	1400	791599	551	55.1	134023	813	47.82	606955	976	9.76
3/3	1500	792104	505	50.5	134864	841	49.47	607899	944	9.44

0500 - mat. temp steadying; shell temp too high, not making the coating
0606 - start automatic on emissions monitor
0700 - mat. temp. ~2450°F; O_2 ~ 20%, operator lowered O_2 to 1.0%
0800 - operator dropped kiln speed to catch material temp drop; O_2 ~1.7%

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0900 - operator raised kiln speed; dropped ID fan damper setting; mat. temp 2475°F
1000 - KS4 to KS1 @ 945; dropped kiln speed 9 rph due to low mat. temp

1100 - cycling kiln op.; kiln speed (58 → 70)
1200 - cycling kiln; speed at 64
1300 - kiln speed up and down; O_2 at 10%; mat. temp from 2400-2600°F
1400 - hot material temp. 2600°F
1900 - burning zone temp. steady; 2540°F
2200-2300 kiln cycling

CONTROL ROOM DATA SHEET - CLINKER, FEEDER, COAL RATES

Day	Time	Clinker Weigh Belt Scale			Feeder Revs Counter			Coal Weigh Belt Scale		
		Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Coal Rate (tons/hr)
3/3	1800	793511	1407	46.9	137556	2692	52.78	610808	2909	9.70
3/3	1900	793953	442	44.2	138428	872	51.29	611748	940	9.40
3/3	2000	794406	453	45.3	139320	892	52.47	612705	957	9.57
3/3	2100	794860	454	45.4	140222	902	53.06	613666	961	9.61
3/3	2200	795414	554	55.4	141105	883	51.94	614630	964	9.64
3/3	2300	795909	495	49.5	142021	916	53.88	615569	939	9.39
3/4	0000	796440	531	53.1	142814	793	46.65	616532	963	9.63

1900 - Burning zone steady at 2540°F
2100 - Temp > 2500 °F
2200 - Kiln cycling.

2300 Kiln cycling
3/4 0000 Kiln in the hole

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BAGHOUSE INLET CONDITIONS

Day 2/29/84
Test Crew HJB, RAF, JM
Site 4

Day	Time	Dynamic Pressure ("H_2O)	Static Pressure ("H_2O)	Barometric Pressure ("Hg)	Temp (°F)	%O_2	Notes
2/29	1508	.59	-7.3	29.10	549	14.0	Baseline O_2
2/29	1645	.53	-7.0	29.10	530	—	Low O_2

FORMS/BAG/4-84

DATA SET 4

APRIL 17-18, 1984

CONTROL ROOM DATA SHEET

KILN #1

DATE 4-17-84

Engineer RCB

1. Test Number	4/17-1	4/17-2	4/17-3	4/17-4
2. Time	1515	1615	1700	1815
3. Baghouse Inlet Temp., °F	575	575	–	575
4. Baghouse ΔP, "H_2O	5.62	6.0	–	5.8
5. Multiclone Inlet Temp., °F	705	715	–	690
6. Kiln ID Fan Damper Position (% open)	72	78	–	78
7. Oxygen, %	1.4	1.5	1.7	1.9
8. Combustibles/CO_2, %	7.2/	0/79	–	0/78
9. Kiln Chain Temp., °F	1340	1340	–	1340
10. Kiln End Housing Pressure, in H_2O	-.4	-.4	–	-.4
11. Kiln Speed, revs/hr (rph)	72	72	–	68
12. Kiln Feeder Speed, revs/min (rpm)	0	0	0	0
13. CO, ppm	<100	<100	–	<100
14. NO_x, ppm	1325	1500	–	1275
15. Kiln Shell Temp, °F (highest reading)				
16. Kiln Feed Bin Level (feet down from bin top)				

	4/17-1	4/17-2	4/17-3	4/17-4
17. Kiln Load, amps	42	–	–	–
18. Kiln Hood Pressure, in H_2O	-.048	-.040	-.055	-0.04
19. Cooler Air Temp., °F	NA	NA	NA	NA
20. Cooler Speed, revs/min (rpm)	11.5	11.5	11.5	11.5
21. Cooler Undergrate Temperature, °F	–	–	–	–
22. Cooler Undergrate Pressure, in H_2O	4.3	4.2	4.1	3.5
23. Material Temperature, °F	2580	Hi Low Swing 2580	2540	2560
24. Coal Mill Motor Amps	34	35	35	34
25. Coal Mill Inlet Pressure, in H_2O	-2.4	CALMER -2.4	-2.4	-2.0
26. Coal Mill Outlet Pressure, in H_2O	16.1	16.1	16.1	16.1
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	74	74	74	74
28. Cyclone Tempering Air, °F	620	620	630	650
29. Coal Mill Inlet Temperature, °F	152	152	152	152
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	–	–	–	–
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	–	–	–	–
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	–	–	–	–
33. Feed Type	–	–	–	–
34. Observations	–	–	–	–

	4/17-1	4/17-2	4/17-3	4/17-4
17. Kiln Load, amps	42	–	–	–
18. Kiln Hood Pressure, in H_2O	-.048	-.040	-.055	-0.04
19. Cooler Air Temp., °F	NA	NA	NA	NA
20. Cooler Speed, revs/min (rpm)	11.5	11.5	11.5	11.5
21. Cooler Undergrate Temperature, °F	–	–	–	–
22. Cooler Undergrate Pressure, in H_2O	4.3	4.2	4.1	3.5
23. Material Temperature, °F	2580	H. Low swing 2580	2540	2560
24. Coal Mill Motor Amps	34	35	35	34
25. Coal Mill Inlet Pressure, in H_2O	-2.4	Calmer -2.4	-2.4	-2.0
26. Coal Mill Outlet Pressure, in H_2O	16.1	16.1	16.1	16.1
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	74	74	74	74
28. Cyclone Tempering Air, °F	620	620	630	650
29. Coal Mill Inlet Temperature, °F	152	152	152	152
30. Coal Feed Rate Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .01 x 12 = tons/hr**	–	–	–	–
31. Clinker Belt Scale Integrator **t = 0 minutes** **t = 5 minutes** **Δ x .1 x 12 = tons/hr**	–	–	–	–
32. Kiln Feeder Revs Integrator **t = 0 minutes** **t = 5 minutes** **(Δ/5 = rpm)**	–	–	–	–
33. Feed Type	–	–	–	–
34. Observations	–	–	–	–

CONTROL ROOM DATA SHEET

KILN #1

DATE 4-17-84

Engineer ACB

1. Test Number	4/17-5	4/17-6	4/17-7	4/17-8
2. Time	2005	2300	2400	0100
3. Baghouse Inlet Temp., °F	575	570	575	570
4. Baghouse ΔP, "H_2O	5.4	5.6	5.4	5.4
5. Multiclone Inlet Temp., °F	710	700	685	680
6. Kiln ID Fan Damper Position (% open)	79	80	77	77
7. Oxygen, %	1.0	1.5	2.3	2.9
8. Combustibles/CO_2, %	0/76	–	–	–
9. Kiln Chain Temp., °F	1340	1360	1330	1340
10. Kiln End Housing Pressure, in H_2O	-.4	-.08	-.04	-.06
11. Kiln Speed, revs/hr (rph)	64	60	64	56
12. Kiln Feeder Speed, revs/min (rpm)	–	12.75	13.5	12.0
13. CO, ppm	<100	<100	<100	<100
14. NO_x, ppm	1000	750	975	825
15. Kiln Shell Temp, °F (highest reading)	–	–	570	–
16. Kiln Feed Bin Level (feet down from bin top)	–	–	–	–

	4/17-5	4/17-6	4/17-7	4/17-8
17. Kiln Load, amps	—	52	53	-
18. Kiln Hood Pressure, in H_2O	-0.04	-0.08	-0.04	-0.04
19. Cooler Air Temp., °F	NA	2000+	2000+	2000+
20. Cooler Speed, revs/min (rpm)	11.5	—	11.5	11.5
21. Cooler Undergrate Temperature, °F	—	—	500+	—
22. Cooler Undergrate Pressure, in H_2O	3.6	3.4	3.5	4.0
23. Material Temperature, °F	2570	2480	2500	2440
24. Coal Mill Motor Amps	34	3[illegible]	35	—
25. Coal Mill Inlet Pressure, in H_2O	-1.2	-1.5	-2.5	-2.5
26. Coal Mill Outlet Pressure, in H_2O	16.2	16.8	16.2	16.2
27. Coal Mill Feed Rate, (% scale x 15 tons/hr)	7.4	10.8	10.9	10.9
28. Cyclone Tempering Air, °F	640	470	680	660
29. Coal Mill Inlet Temperature, °F	152	$\frac{152}{570}$	$\frac{152}{380}$	$\frac{152}{380}$
30. Coal Feed Rate Integrator t = 0 minutes t = 5 minutes Δ x .01 x 12 = tons/hr	—	—	—	—
31. Clinker Belt Scale Integrator t = 0 minutes t = 5 minutes Δ x .1 x 12 = tons/hr	—	—	—	—
32. Kiln Feeder Revs Integrator t = 0 minutes t = 5 minutes (Δ/5 = rpm)	—	—	—	—
33. Feed Type	—	—	—	—
34. Observations	—	—	—	—

CONTROL ROOM DATA SHEET - CLINKER, FEEDER, COAL RATES

Day	Time	Clinker Weigh Belt Scale			Feeder Revs Counter			Coal Weigh Belt Scale		
		Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Coal Rate (tons/hr)
4-17	1330	359843	—	—	941481	—	—	575217	—	—
4-17	1350	360015	172	51.6	941763	282	49.8	575552	335	10.05
4-17	1410	360187	172	51.6	942044	281	49.6	525886	334	10.02
4-17	1430	360355	168	50.4	942323	279	49.2	576221	335	10.05
4-17	1445	360482	127	50.8	942534	211	49.6	576474	253	10.12
4-17	1500	360605	123	49.2 ✓	942741	207	48.7	576723	249	9.96
4-17	1510	360684	79	47.4	942872	131	46.2	576884	161	9.66
4-17	1520	360771	87	52.2	943024	152	53.6	577057	173	10.38
4-17	1530	360845	74	44.4	943156	132	46.6	577206	149	8.94
4-17	1540	360968	123	73.8	943342	186	76.2	577427	221	13.26
4-17	1550	361033	65	39.0	943457	115	40.6	577556	129	7.74
4-17	1601	361140	107	58.4	943638	181	58.1	577762	206	12.36
4-17	1610	361211	71	47.3	943754	116	45.5	577901	139	8.34
4-17	1620	361297	86	51.6	943898	144	50.8	578068	167	10.02
4-17	1630	361386	89	53.4	944047	149	52.6	578238	170	10.20

CONTROL ROOM DATA SHEET - CLINKER, FEEDER, COAL RATES

Day	Time	Clinker Weigh Belt Scale			Feeder Revs Counter			Coal Weigh Belt Scale		
		Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Coal Rate (tons/hr)
4-17	1640	361469	83	49.8	944190	143	50.5	578401	163	9.78
4-17	1650	361578	109	65.4	944358	168	59.3	578598	197	11.82
4-17	1700	361650	72	43.2	944491	133	46.9	578748	150	9.00
4-17	1710	361729	79	47.4	944626	135	47.6	578903	155	9.30
4-17	1720	361814	85	51.0	944771	145	51.2	579073	170	10.20
4-17	1730	361908	94	56.4	944916	145	51.2	579245	172	10.32
4-17	1740	362005	97	58.2	945076	160	56.5	579440	195	11.70
4-17	1800	362177	172	51.6	945325	249	43.9	579758	318	9.54
4-17	1810	362235	58	34.8	945449	124	43.8	579897	139	8.34
4-17	1820	362303	68	40.8	945580	131	46.2	580055	158	9.48
4-17	1830	362381	78	46.8	945718	138	48.7	580226	171	10.26
4-17	1840	362460	79	47.4	945861	143	50.5	580402	176	10.56
4-17	1850	362540	80	48.0	946002	141	49.8	580576	174	10.44
4-17	1900	362605	65	39.0	946123	121	42.7	580718	142	8.52

CONTROL ROOM DATA SHEET - CLINKER, FEEDER, COAL RATES

Day	Time	Clinker Weigh Belt Scale			Feeder Revs Counter			Coal Weigh Belt Scale		
		Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Coal Rate (tons/hr)
4/17	1910	362700	–	–	946281	–	–	580911	–	–
4/17	1920	362774	74	44.4	946403	122	43.1	581060	149	8.9
4/17	1930	362860	86	51.6	946546	143	50.5	581236	176	10.6
4/17	1940	362948	88	52.8	946685	139	49.1	581417	181	10.9
4/17	1950	363036	88	52.8	946821	136	48.0	581598	181	10.9
4/17	2000	363098	62	37.2	946924	103	36.4	581737	139	8.3
4/17	2010	363190	92	55.2	947065	141	49.8	581935	198	11.9
4/17	2020	363254	64	38.4	947171	106	37.4	582056	121	7.3
4/17	2030	363360	106	63.6	947311	140	49.4	582292	236	14.2
4/17	2050	363490	130	39.0	947579	268	47.3	582595	303	9.1
4/17	2100	363573	83	49.8	947695	116	40.9	582756	161	9.7
4/17	2110	363648	75	45.0	947820	125	44.1	582911	155	9.3
4/17	2140	363855	207	41.4	948190	370	43.5	583357	446	8.9
4/17	2200	364008	153	45.9	948448	258	45.5	583687	330	6.6
4/17	2210	364077	69	41.4	948571	123	43.4	583843	156	9.4

CONTROL ROOM DATA SHEET - CLINKER, FEEDER, COAL RATES

		Clinker Weigh Belt Scale			Feeder Revs Counter			Coal Weigh Belt Scale		
Day	Time	Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Coal Rate (tons/hr)
4/17	2220	364176	99	59.4	948714	143	50.5	584029	186	11.2
4/17	2230	364282	106	63.6	948824	110	38.8	584173	144	8.6
4/17	2240	364390	108	64.8	948950	126	44.5	584365	192	11.5
4/17	2250	364478	88	52.8	949073	123	43.4	584512	147	8.8
4/17	2300	364553	75	45.0	949179	106	37.4	584656	144	8.6
4/17	2310	364661	108	64.8	949361	182	64.2	584900	244	14.6
4/17	2320	364699	38	22.8	949431	70	24.7	584991	91	5.5
4/17	2330	364780	81	48.6	949590	159	56.1	585195	204	12.2
4/17	2340	364846	66	39.6	949713	123	43.4	585332	137	8.2
4/17	2350	364912	66	39.6	949857	144	50.8	585492	160	9.6
4/17	2400	364995	83	49.8	949995	138	48.7	585685	193	11.6
4/18	2410	365062	67	40.2	950115	120	42.4	585825	140	8.4
4/18	2420	365140	78	46.8	950233	118	41.6	585981	156	9.4
4/18	2430	365218	78	46.8	950353	120	42.4	586137	156	9.4
4/18	2440	365302	84	50.4	950471	118	41.6	586304	167	10.0

CONTROL ROOM DATA SHEET - CLINKER, FEEDER, COAL RATES

Day	Time	Clinker Weigh Belt Scale			Feeder Revs Counter			Coal Weigh Belt Scale		
		Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Clinker Rate (tons/hr)	Integrtr Reading	Δ	Coal Rate (tons/hr)
4/18	2450	365394	92	55.2	950588	117	41.3	586479	175	10.5
4/18	0100	365492	98	58.8	950687	99	34.9	586620	141	8.5

INSTRUMENT CALIBRATION RECORD

DATE 4-17-84

TEST SITE 4, Kiln Exit

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
1310	999	1.5	301	30.0	-	
1350	993	1.5	303	28.6	-	
1455	1019	1.5	299	30.2	-	
1600	1007	1.5	299	29.7	-	
1655	794	1.5	301	30.5	-	
1755	994	1.5	300	29.8	-	
1855	998	1.5	300	30.0	-	
1955	986	1.5	305	31.5	-	
2055	1001	1.5	298	30.0	-	
2155	1009	1.5	299	29.7	-	
2300	1007	1.5	292	30.0	-	
2355	997	1.6	303	30.2	-	
0055	999	1.5	300	29.3		

INSTRUMENT CALIBRATION RECORD

DATE 4-17-84

TEST SITE 4
Baghouse Inlet

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
1656-1700	302	9.0	183	–		
1806-1810	296	9.0	–	–		
1918-1920	296	9.0	327	–		
2040-2044	336	8.8	336			
2201-2204	301	9.0	327			

INSTRUMENT CALIBRATION RECORD

DATE 4-17-84

TEST SITE 4
Baghouse Inlet

INSTRUMENT	NO	O2	CO	CO2	SO2	
TIME						
1656-1700	302	9.0	183	–		
1806-1810	296	9.0	–	–		
1918-1920	296	9.0	327	–		
2040-2044	336	8.8	336			
2201-2204	301	9.0	327			

SITE 4
NITROGEN INJECTION DATA SHEETS

Sample Location Burnerline
Date 4-17-84
Test Crew JM

Time	N_2 Flowrate (scfh)	N_2 Injection Temp at Mill (°F)	Mill Outlet O_2, % dry	Comments
1700			18.7	Start Calibrate 21%
1702			19.0	
1704			18.7	
1706			18.7	
1708			18.7	
1710			18.7	Going to 100,000
1712			17.0	Pumped Down
1755			–	Start-Calibrate 21%-Pumped back
1800	50700	307	20.5 –	on Line 50,000
1802			20.2	
1804			20.2	
1806			20.2	Calibrate 21%
1808			20.2	
1810			20.2	
1812			20.2	
1814			20.2	
1816			20.2	
1818			20.2	
1820	106000	540	19.7	100,000
1822			19.7	
1824			19.2	
1826			17.7	
1827	147000	530	17.0	
1828			16.9	
1829			15.3	147,000
1830			15.2	
1831			15.2	200,000
1832			15.2	
1834			17.6	201,000

SITE 4
NITROGEN INJECTION DATA SHEETS

Sample Location
Date 4-17-84
Test Crew JM

Time	N_2 Flowrate (scfh)	N_2 Injection Temp at Mill (°F)	Mill Outlet O_2, % dry	Comments
1836	201000	660	17.6	Wrong gear
1838			17.6	
1840			17.6	
1842			13.6	
1843	234,000	403	13.2	230,000
1845			13.2	234,000 - Steady
1850	201,000	498	13.7	
1852			14.0	Drifting up Slowly
1854			14.0	Decreased Flow Rate
1855			14.2	
1856			14.0	
1858			14.2	
1900			14.2	Cal. beate 21%
1905			14.2	
1910			14.2	
1915			14.2	
1920			14.2	201,000
1925			14.2	
1930	201,000	503	14.2	Cal. beate 21.8%
1935			14.2	
1940			14.3	
1945			14.2	
1950			14.2	201,000 500° Temp.
1955			14.3	
2000			14.3	Cal. beate 21%
2005			14.2	
2010			14.2	
2015			14.2	
2020			14.2	

SITE 4
NITROGEN INJECTION DATA SHEETS

Sample Location ____________

Date 4-17-84

Test Crew ____________

Time	N_2 Flowrate (scfh)	N_2 Injection Temp at Mill (°F)	Mill Outlet O_2, % dry	Comments
2025			14.2	Calibrate 21%
2030			14.2	201,000
2035	201000	503	14.1	
2040			14.0	
2045			14.1	
2050			14.1	
2054			—	Nitrogen off
2055			14.5	Nitrogen Back on
2056			13.2	
2057			13.7	
2058			13.9	
2059	201,000	490	13.8	
2100			13.9	
2105			13.7	
2110			13.7	201,000
2115			13.7	Calibrate 20.9%
2120			13.7	
2125			13.7	
2130			13.9	
2135	234,000	420	14.2	
2140			14.5	
2142			13.6	
2145			13.0	234,000
2150			13.4	
2155			13.2	
2200			13.2	
2205			13.2	234,000
2210			13.2	
2215			13.2	

SITE 4
NITROGEN INJECTION DATA SHEETS

Sample Location ____________
Date 4-17-84
Test Crew JM

Time	N_2 Flowrate (scfh)	N_2 Injection Temp at Mill (°F)	Mill Outlet O_2, % dry	Comments
2220			13.2	
2225			13.2	
2230			13.2	Increasing Flow to 250,000
2235			12.5	
2240			12.6	
2245			12.6	
2250			12.6	
2255			12.6	
2300			12.6	nitrogen off momentarily then back on
2305			14.5	Decreasing Flow Rate
2306			14.0	
2307			14.5	
2310			17.0	
2315			15.5	
2320			16.0	
2330			17.0	
2345			18.0	
2350			17.9	
2355			18.1	
2400			20.8	Nitrogen off

F-464

COMMERCIAL TESTING & ENGINEERING CO.
GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

WESTERN DIVISION MANAGER
GAIL D. PALMER

SINCE 1908

PLEASE ADDRESS ALL CORRESPONDENCE TO
1489 CANAL AVE., LONG BEACH, CA 90813
OFFICE TEL. (213) 437-6668

KVB
18006 Skypark Blvd.
P.O. Box 19518
Irvine, Ca. 92714

April 25, 1984

Sample identification by

Commercial Testing & Engineering

Coal Sample
4/18/84
0010

Kind of sample reported to us	Coal
Sample taken at	xxxx
Sample taken by	KVB
Date sampled	4/18/84
Date received	4/19/84

Analysis report no. 77-2033

PROXIMATE ANALYSIS

	As Rec'd	Dry Basis
% Moisture	2.95	xxxxx
% Ash	15.44	15.91
% Volatile	34.37	35.41
Fixed Carbon	47.24	48.68
	100.00	100.00
Btu/lb.	11539	11890
% Sulfur	0.49	0.51

ULTIMATE ANALYSIS

	As Rec'd	Dry Basis
% Moisture	2.95	xxxxx
% Carbon	66.16	68.17
% Hydrogen	4.44	4.58
% Nitrogen	1.24	1.28
% Chlorine	0.07	0.07
% Sulfur	0.49	0.51
% Ash	15.44	15.91
Oxygen(diff)	9.20	9.48

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Dennis Shaw
Manager, Long Beach Laboratory

Charter Member

Original Copy Watermarked
For Your Protection

BAGHOUSE INLET CONDITIONS

Day 4/17/84
Test Crew HJB, RAF
Site 4

Day	Time	Dynamic Pressure ("H_2O)	Static Pressure ("H_2O)	Barometric Pressure ("Hg)	Temp (°F)	%O_2	Notes
4/17	1646	.61	-6.8	29.15	568	13.4	Baseline
4/17	2010	.64	-6.7	29.15	576	13.0	N_2 Injection
4/17	2245	.60	-7.4	29.15	574	13.5	N_2 Injection
4/18	0024	.56	-7.3	29.15	571	13.5	Baseline

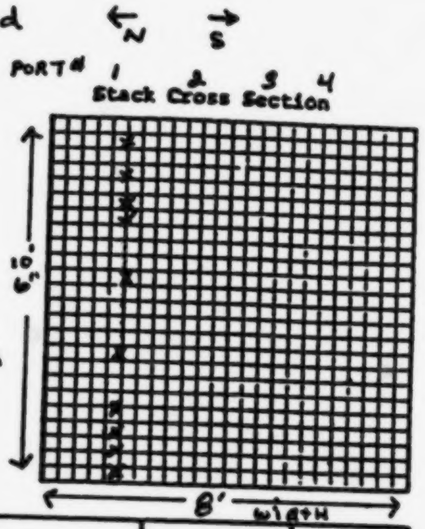
DATA SET 5

BAGHOUSE INLET VELOCITY TRAVERSE

VELOCITY TRAVERSE

Project: EPA.
Date: 2/22/84
Location: Site 4
Unit: Kiln #1
Test: Velocity Traverse
Fuel: Coal
Test Description: As Found
Personnel: RAF, ACB
Barometric Press. (in. Hg): 29.07 @ 78 °F
Absolute Static Press. in Stack (in. Hg): 28.52 (P_s)
Pitot Tube Coefficient: .828 (C_p)

$$V_s = 85.48\ C_p \left[\frac{T_s \Delta P}{P_s M_s}\right]^{1/2}$$



Time	Traverse Point Port	Traverse Point Depth	Velocity Head (in. H_2O)	Gas Temp. (°F)	Gas Temp. (°R)	Molecular Wt.	Velocity (ft/sec)	O_2 Conc. (% Dry)
			ΔP		T_S	M_S	V_S	
0915	2	.5'	.49	540	1000	29.6	53.92	14.3
	2	1'	.58	548	1068	29.6	60.97	14.3
	2	1.5'	.61	542	1002	29.6	60.23	14.3
	2	2'	.62	530	990	29.6	60.35	14.3
	2	5.25'	.70	563	1023	29.6	65.19	14.3
	2	7'	.65	567	1027	29.6	62.94	14.3
	2	9'	.65	568	1028	29.6	62.97	14.3
	2	9.5'	.72	569	1029	29.6	66.31	14.3
	2	10'	.70	564	1024	29.6	60.10	14.3
0930	2	10.5'	.75	549	1009	29.6	67.01	14.3
0935	1	10.5'	.58	523	983	29.6	58.17	14.3
	1	10'	.75	552	1012	29.6	67.11	14.3
	1	9.5'	.80	555	1015	29.6	69.17	14.3
	1	9'	.80	556	1016	29.6	69.45	14.3
	1	7'	.77	548	1008	29.6	67.87	14.3
	1	5.25'	.65	540	1000	29.6	62.11	14.3

VELOCITY TRAVERSE

Project: EPA-
Test Description: As Found
Date: 2/22/84
Location: Site 4
Unit: Kiln #1
Test: Velocity Traverse
Personnel: RAF, ACB
Fuel: Coal
Barometric Press. (in. Hg): 29.07 @ 78°F
Absolute Static Press. in Stack (in. Hg): 28.52 (P_s)
Pitot Tube Coefficient: .828 (C_p)

$$V_S = 85.48\ C_p \left[\frac{T_S \Delta P}{P_S M_S}\right]^{1/2}$$

Stack Cross Section

Time	Traverse Point Port	Depth	Velocity Head (in. H_2O)	Gas Temp. (°F)	Gas Temp. (°R)	Molecular Wt.	Velocity (ft/sec)	O_2 Conc. (% Dry)
			ΔP		T_S	M_S	V_S	
0943	1	2'	.63	540	1000	29.6	61.14	14.3
	1	1.5'	.63	540	1000	29.6	61.14	14.3
	1	1.0'	.60	535	995	29.6	59.52	14.3
	1	.5'	.52	520	980	29.6	54.99	14.3
	3	10.5'	.43	537	987	29.6	50.19	14.3
	3	10'	.62	546	1006	29.6	60.84	14.3
	3	9.5'	.58	550	1010	29.6	58.96	14.3
	3	9'	.58	549	1009	29.6	58.93	14.3
	3	7'	.53	551	1011	29.6	56.39	14.3
	3	5.25'	.55	552	1012	29.6	57.47	14.3
	3	2'	.52	551	1011	29.6	55.86	14.3
	3	1.5'	.52	551	1011	29.6	55.86	14.3
	3	1'	.52	539	999	29.6	55.52	14.3
	3	.5'	.55	507	967	29.6	56.18	14.3
	4	10.5'	.41	522	982	29.6	48.88	14.3
	4	10'	.50	527	987	29.6	54.12	14.3

6002-13

VELOCITY TRAVERSE

Project: EPA
Test Description: As Found
Date: 2/22/84
Location: Site 4
Unit: Kiln #1
Test: Velocity Traverse
Personnel: RAF, RCB
Fuel: Coal
Barometric Press. (in. Hg): 29.07 @ 78 °F
Absolute Static Press. in Stack (in. Hg): 28.52 (P_s)
Pitot Tube Coefficient: .828 (C_p)

$$V_S = 85.48\, C_p \left[\frac{T_S \Delta P}{P_S M_S}\right]^{1/2}$$

Stack Cross Section

Time	Traverse Point Port	Depth	Velocity Head (in. H_2O)	Gas Temp. (°F)	Gas Temp. (°R)	Molecular Wt.	Velocity (ft/sec)	O_2 Conc. (% Dry)
			ΔP		T_S	M_S	V_S	
	4	9.5'	.50	542	1002	29.6	54.53	14.3
	4	9'	.49	540	1000	29.6	53.92	14.3
	4	7'	.35	543	1003	29.6	45.64	14.3
	4	5.25'	.44	549	1009	29.6	51.33	14.3
	4	2'	.53	552	1012	29.6	56.42	14.3
	4	1.5'	.53	553	1013	29.6	56.45	14.3
	4	1'	.47	544	1004	29.6	52.91	14.3
	4	.5'	.37	490	950	29.6	45.67	14.3

6002-13

VELOCITY TRAVERSE

Project: EPA
Test Description: As Found
Date: 2/22/84
Location: Site 4
Unit: Kiln # 1
Test: Velocity TRAVERSE
Personnel: RAF, RCB
Fuel: CoAL
Barometric Press. (in. Hg): 29.07 @ 78 °F
Absolute Static Press. in Stack (in. Hg): 28.52 (P_s)
Pitot Tube Coefficient: .828 (C_p)

$$V_s = 85.48\ C_p \left[\frac{T_s \Delta P}{P_s M_s}\right]^{1/2}$$

Stack Cross Section

Time	Traverse Point Port	Traverse Point Depth	Velocity Head (in. H_2O)	Gas Temp. (°F)	Gas Temp. (°R)	Molecular Wt.	Velocity (ft/sec)	O_2 Conc. (% Dry)
			ΔP		T_s	M_s	V_s	
	4	9.5'	.50	542	1002	29.6	54.59	14.3
	4	9'	.49	540	1000	29.6	53.92	14.3
	4	7'	.35	543	1003	29.6	45.64	14.3
	4	5.25'	.44	549	1009	29.6	51.33	14.3
	4	2'	.53	552	1012	29.6	56.42	14.3
	4	1.5'	.53	553	1013	29.6	56.45	14.3
	4	1'	.47	544	1004	29.6	52.91	14.3
	4	.5'	.37	490	950	29.6	45.67	14.3

6002-13

PITOT TUBE IDENTIFICATION NUMBER: P-3-1 **DATE:** 11/3/83

CALIBRATED BY: M. FISHER

	"A" SIDE CALIBRATION			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$*	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.44	.65	.823	.004
2	.44	.64	.829	.002
3	.44	.64	.829	.002
		$\bar{C}_p$ (SIDE A)	.827	

$$* \; C_{p(s)} = \sqrt{\frac{\Delta P(STD.)}{\Delta P(s)}}$$

	"B" SIDE CALIBRATION			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.44	.635	.832	.002
2	.44	.64	.829	.001
3	.44	.64	.829	.001
		$\bar{C}_p$ (SIDE B)	.83	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} < 0.01$$

$$\left| \bar{C}_p \text{ (SIDE A)} - \bar{C}_p \text{ (SIDE B)} \right| \longleftarrow \text{MUST BE} < 0.01$$

Figure 2-9. Pitot tube calibration data.